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MOTORSHIP

Devoted to Commercial and Naval Motor Vessels

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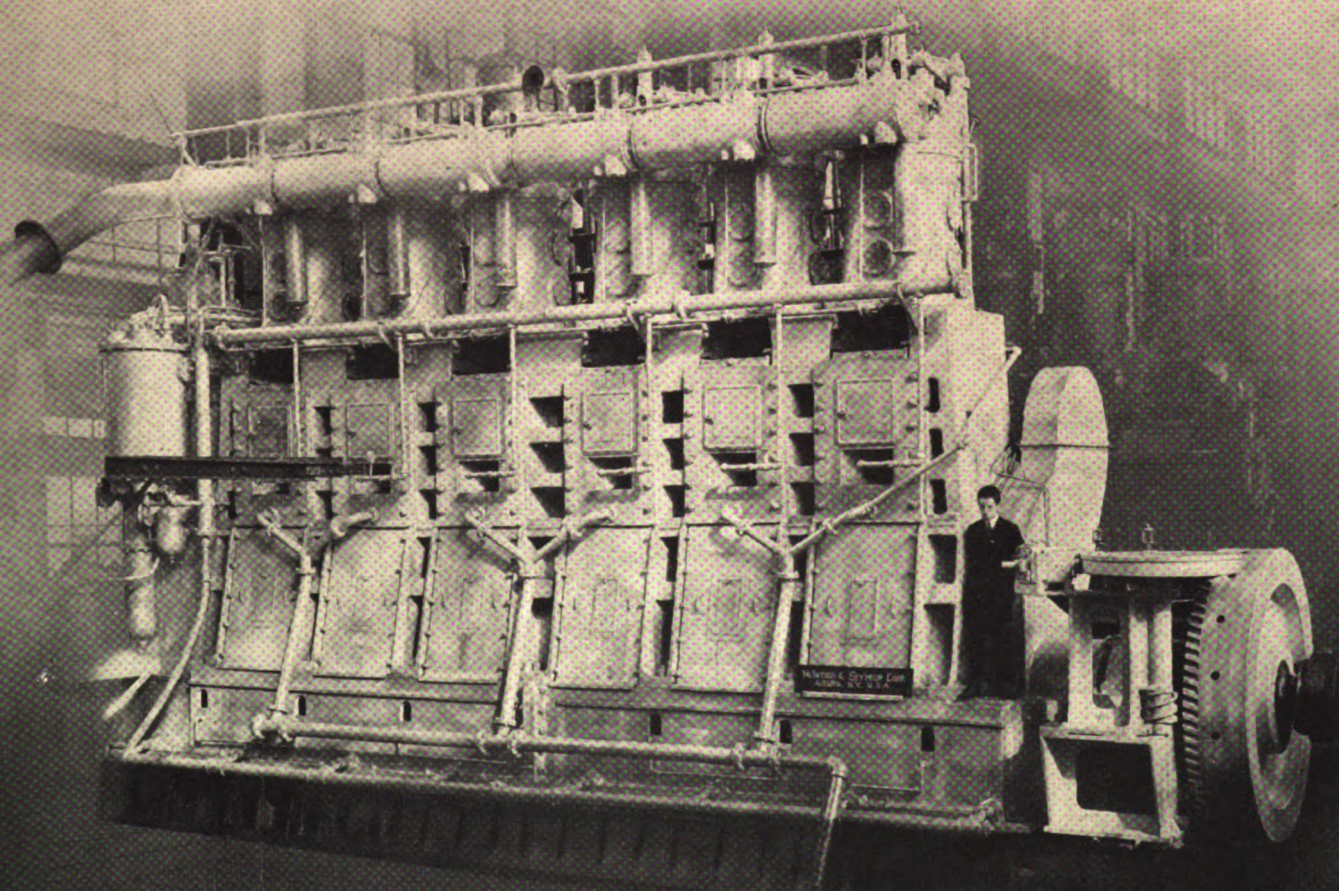
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DIESEL MARINE ENGINES FOR ALL CLASSES OF SHIPS



M^cINTOSH & SEYMOUR CORPORATION
AUBURN, N. Y., U.S.A.

EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

MOTORSHIP

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PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

Vol. VII

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No. 6

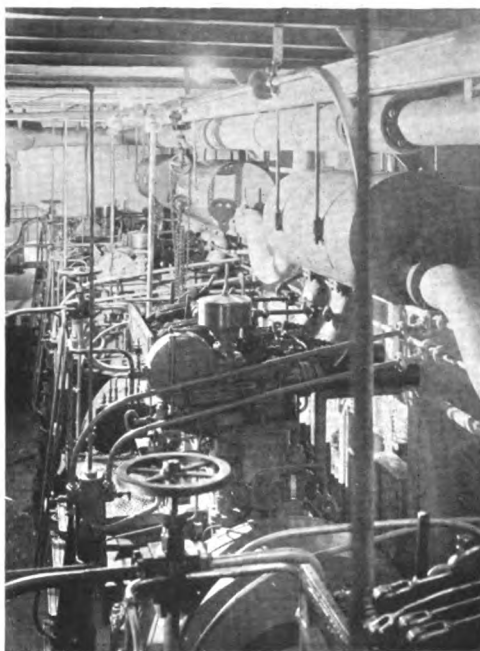
"Californian," a Big All-American Motorship

UNQUESTIONABLY the new motorships of the American-Hawaiian Steamship Co., which are being operated by the United American Lines, will do much to turn the tide in favor of Diesel propulsion in this country, and the initial performances of the "Californian" demonstrate beyond argument that America can build oil-engined vessels equal to or better than those turned-out by the most experienced European shipyards. Not that we had any doubt over the matter do we say this, but because interests opposed to Diesel-drive have endeavored to instil into the minds of shipowners that Americans can neither construct nor operate high-powered Diesel-engines. The "Californian" and her sister motorship "Missourian" are all-American throughout, and are the first twin-screw four-cycle Diesel freighters of over 10,000 tons deadweight to be entirely constructed and engined in this country.

Credit for the ships is due to a number of individuals, not to overlook the pressure exerted by Wm. Averell Harriman following his personal investigations into the Diesel propulsion question, particularly the Burmeister & Wain design. He has shown the same courage and foresight that characterized his father E. H. Harriman, the railroad magnate. Also, much depended upon the findings of J. D. Tomlinson, who is one of the best ship operators the country has to-day, and who for several years has evinced a deep interest in motorships, and became convinced of the economies to be derived from them. Much responsibility has rested upon Bernard Mills, superintendent-engineer of the owners, who probably has visited more incoming foreign and domestic motorships than any other American shipping engineer, frequently in company with ourselves. Incidentally, we accompanied Mr. Tomlinson during his first inspection of a motorship some years ago.

We have had the pleasure of making the short voyage from New York to Boston aboard the "Californian," and thus had the privilege of having first-hand observation of her performance. No other magazine or newspaper representative was aboard. She is a splendid ship in every way, and undoubtedly will prove a very profitable cargo-carrier, even tho' her first cost is somewhat high due to hav-

First of the American-Hawaiian Line's Cramp B. & W. Diesel-driven Freighters Is an Unqualified Success on Initial Performances



The four auxiliary Diesel electric-generating sets of the "Californian"

ing been ordered nearly eighteen months ago when prices were considerably higher than they are to-day. Also, she is of much higher-grade construction and equipment than the average American freighter of her tonnage, every modern appliances for efficient navigation, propulsion and comfort of her crew being installed. Her entire Diesel-engine installation was built and carried out by the Wm. Cramp & Sons Ship & Engine Co. of Philadelphia, while the hull was designed and built at the Merchant Shipyard, Chester, Pa., under the supervision of Mr. Mills, and his assistants, H. J. Hartridge and A. S. Robertson. Credit is due to everybody concerned for having turned out a splendid job that is a credit to the U. S. Merchant Marine. Our readers know that we are not given to undue praise,

but we stepped ashore at Boston a few days ago enthusiastic with the entire ship and machinery. Never have we been on a smoother running vessel, and although she is a freighter a voyage round the world on her would be a pleasure cruise. Her limited amount of passenger accommodations is very comfortable.

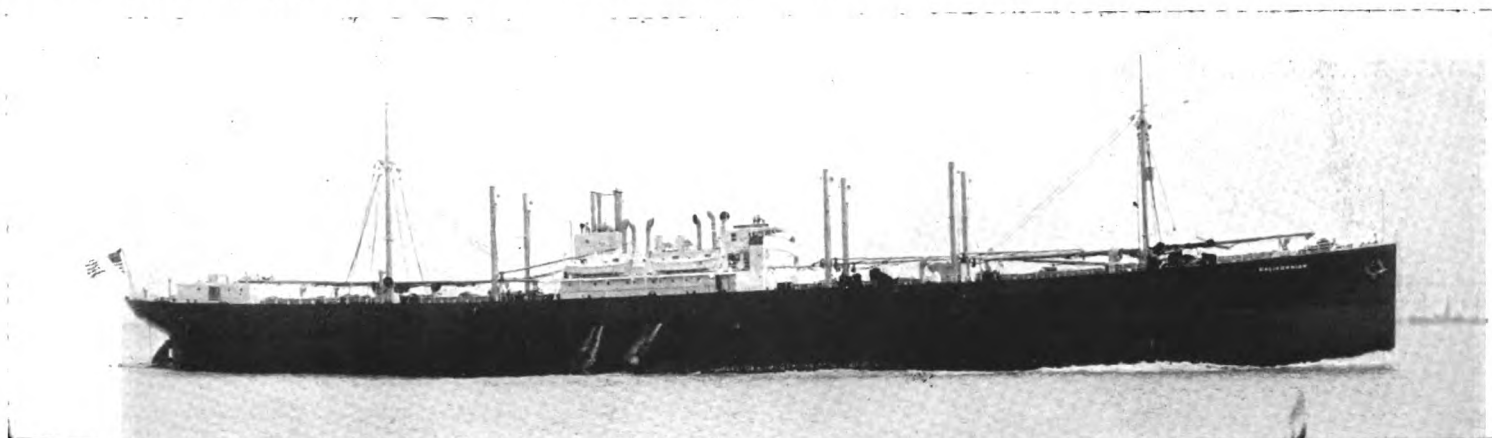
The "Californian" left the Morse Dry Dock, Brooklyn, New York on Thursday afternoon, May 11, passing the Ambrose light at 6:22 P. M., and arrived at Boston at 4:31 P. M. on the following afternoon daylight saving time in both cases. There was not even a drop in engine speed, the entire trip of 312 nautical-miles, with the exception of a planned detention of 22 minutes for running astern for the purpose of securing indicator cards with the engines reversed. This was done early Friday afternoon 7 miles north of the Slue light-ship. The speed averaged with the ship light and down by the stern was 13.28 knots, and the fuel used was Texas oil of 23.5 Baumé and averaged about 178 gallons or $4\frac{1}{4}$ barrels per hour for all purposes, the cost of other oil being \$1.57 per barrel.

A test was made of the consumption during one three hour stage, and this figured out at 0.306 lb. per I.H.P. hour with the two engines together developing 4,420 I.H.P. and the ship making 13 knots. The propellers are four-bladed of bronze 13 ft. 6 in. dia. made by Cramps. Captain Wm. Lyons is most enthusiastic over his new ship. She handles better than any craft he has commanded, and had no trouble whatever in docking without the aid of a tug. On a 4 hours' test run en route to New York on the trip back, 4735 i.h.p. was developed at 121 r.p.m.

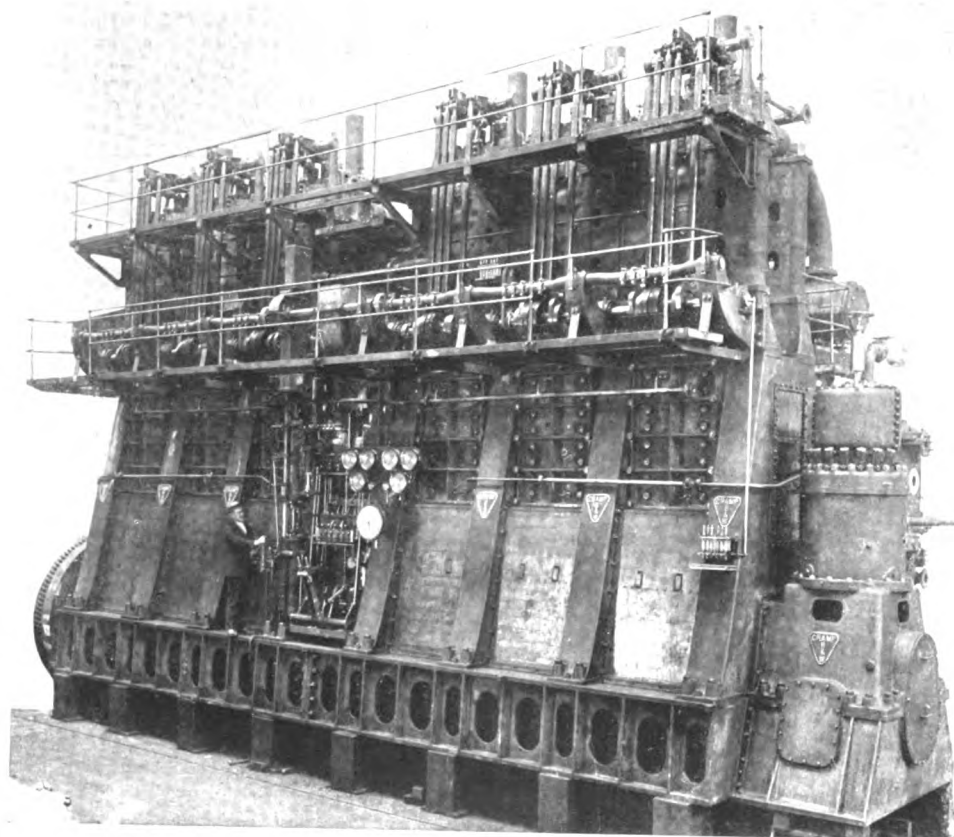
The ship loaded the first part of her cargo at Boston and left the next day for New York, and averaged 14.09 knots on this run. She next proceeds to Philadelphia and Baltimore, thence to the Pacific Coast. From the Coast she will go to Hamburg, Liverpool, etc., and as most Diesel ships are doing, will take a full load of cargo. She will be back again in about four months.

The officers and engineers of the "Californian" are as follows:

Master	Capt. Wm. Lyons
1st. Officer	L. A. Ackerman
2nd. Officer	C. H. Fincke



Broadside view of the "Californian" in light condition



One of the twin 2,250 I.H.P. Cramp-B. & W. Diesel engines of the "Californian"

3rd Officer M. N. Brann
Chief-Engineer R. H. Boyt
1st Assistant-Engineer Irvin Burks
2nd Assistant-Engineer Turnage
3rd Assistant-Engineer Poling
4th Assistant-Engineer John Connal
Guarantee-Engineer Oscar Mattsson

Altogether she has a crew of 37 men and officers, of which the engine-room staff consists of 14 men, there being five senior-motormen, three junior-motormen and one electrician.

It is interesting to compare her crew with that of the British registry motorship "Mississippi" of the Atlantic Transport Company, regularly calling at Baltimore, Md. The English ship carries 42 men and officers, of which the engines require 10 licensed engineers and three motormen. But the total wages of the American vessel, of course, are higher, these amounting to \$3,248 per month. We do not know the exact total of the wages paid on a British ship, but presume that it is between 20 and 25 percent less, in accordance with the average British scale. It is obvious that the subsidy proposed in the new legislation, together with the economy to be gained by Diesel engines, will offset the higher cost of operating U. S. vessels.

As regards the dimensions, etc. of the "Californian," these are as follows:

Capacity

Loaded displacement at 28'6" dft. 16,500 tons
Light displacement 5,300 tons
Net cargo-capacity on long-distance voyage 9,585 tons
Deadweight capacity 11,200 tons
Underdeck cargo-capacity (grain) 598,492 cu. ft.
Underdeck cargo-capacity (hales) 533,282 cu. ft.
Capacity of deep tanks & hatches 50,610 cu. ft.
Refrigerated space 1,277 cu.ft.

TOTAL CUBIC CAPACITY ... 650,379 cu. ft.

Fuel-capacity (in double bottoms, settling-tank, and supply tanks) 1,368 tons
Fresh-water capacity 208 tons
Length of machinery space (incl. thrust recess) 60'8"

Dimensions

Length O. A. 461'7½"
Length B. P. 445'0"
Breadth M. D. 59'8"
Depth M. D. to S. D. 39'0"

Draught, loaded 28'6"
Block Coefficient 0.76
Midsection Coefficient 0.986

Power

Twin six-cylinder 29½"x45¼" at
115 R. P. M. 2,250 I. H. P. each
Four auxiliary Diesel-electric-sets of
65 K. W. 75 to 100 b. h. p. each
Matthews main wireless and emergency
lighting-set 15 K. W.
Emergency radio-set 2 K. W.

Speed and Consumption

Designed speed 11¾ knots
Trial speed 12.57 to 13 knots
Maiden-voyage speed (light) 13 knots
Fuel-Consumption per I. H. P. hour ... 0.30 lb
Fuel-consumption per 24 hours (all purposes) 14 tons

Weights

Weight of two main engines together ... 545 tons
Complete weight of machinery, including gen. auxiliary Diesel, tanks, etc. 930 tons
Weight of ship and machinery 5,300 tons

Engine builders' trials were run on May 1st and 2nd off the Delaware Breakwater. The "Californian" left the Cramp Yard at 8:40 A. M. and arrived at the Breakwater at 4:00 P. M. After adjusting the compass, three runs were made over the mile course, with the following results:

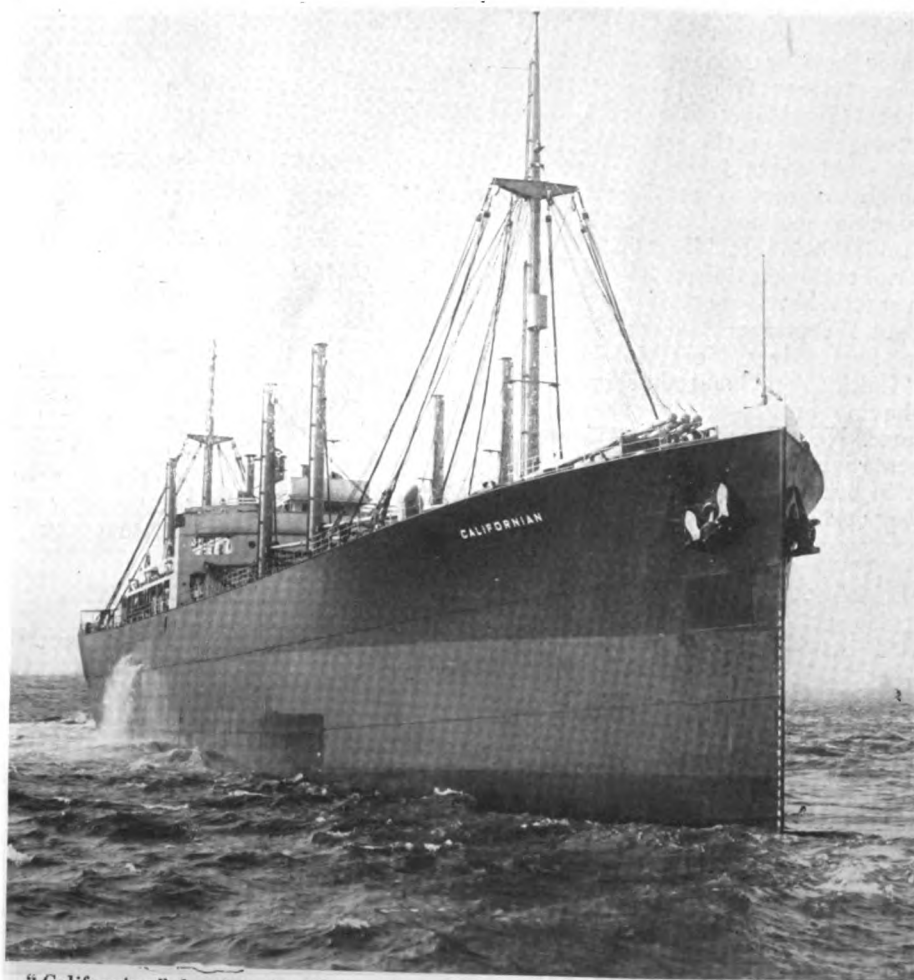
R. P. M. mean 114.62
M. I. P. mean, main engines 82.8 lbs.
I H. P. mean, main engines 4,330
Knots speed, corrected for tide 12.57
Slip of propellers 5.4%

The maximum speed made over the mile course (uncorrected for tide) was 13.9 knots.

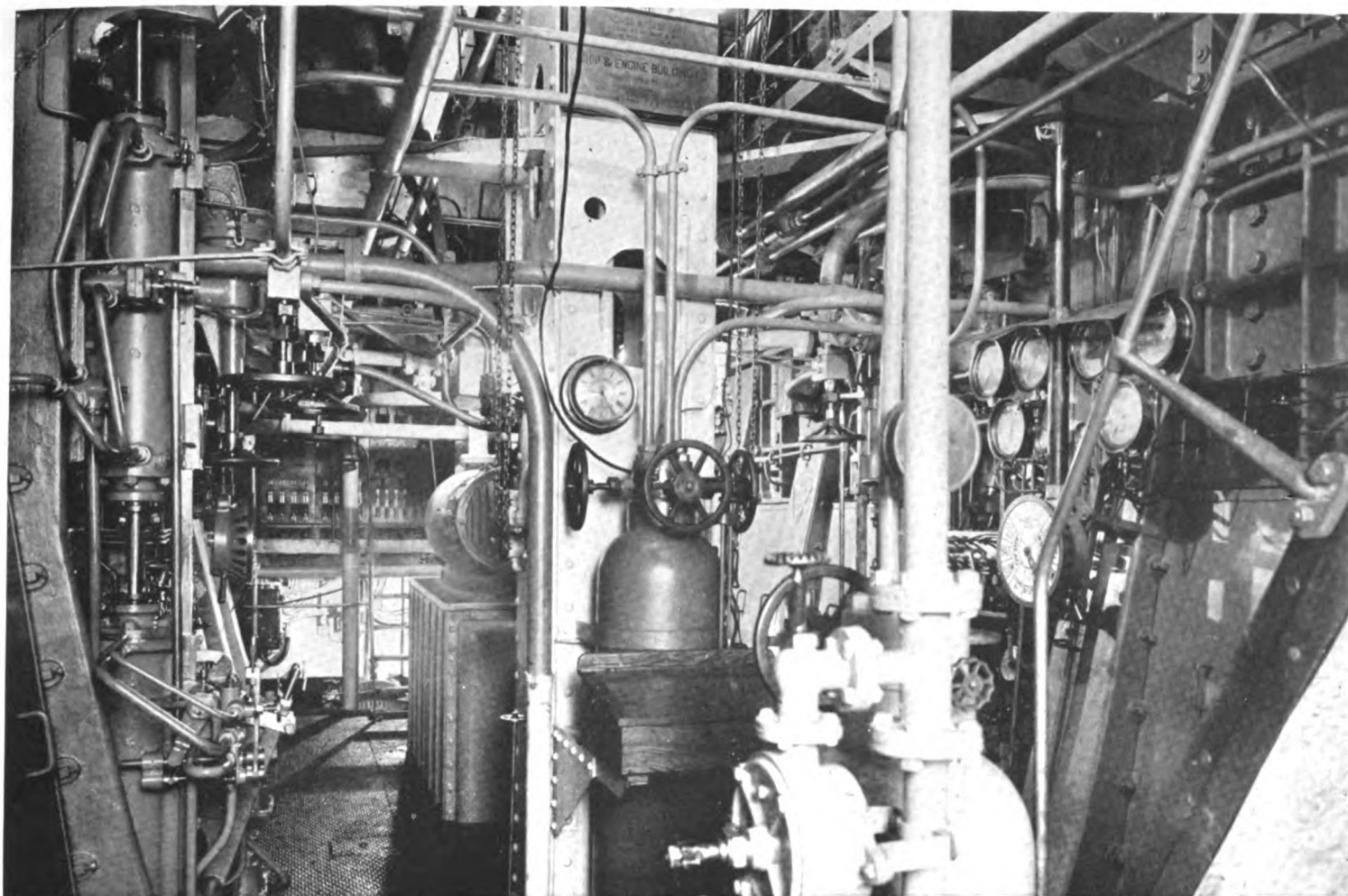
The next day, beginning at 7:30 A. M., a six-hour continuous run was made. This consisted of running two and a half hours out to sea and back, and three and a half hours up the Delaware Bay and River to Reedy Island. Due to the drag of the ship aft, the draft being 8' 3" forward and 18' 0" aft, the speed of the vessel was very sensitive to the depth of the water. For this reason, and the necessity of following the ship channel, the last two hours were not considered in the consumption test, and the consumption of oil was taken only for the first four hours, when the conditions of drive of vessel were more uniform. In the open sea the engines turned up a maximum of 119.25 r.p.m. without any change in the control of the engines, and which corresponds to slightly over 13 knots.

The result of the four-hour consumption test is as follows:

Oil-consumption main engines and one aux. engine 1,372 lbs. per hour
I. H. P. main engines 4,417



"Californian" leaving the Morse Dry Dock and starting on her trip to Boston. She averaged 13.28 knots en route, and 14.09 knots on the return trip with fuel, and with 800 tons of cargo forward



Looking 'tween two main engines of the "Californian." The switchboard can be seen at the forward end

K. W. load, auxiliary engine 50
 R. P. M. mean, main engines 117.58
 Corresponding speed from standardization
 runs 12.9 knots
 M. I. P. corresponding speed from standardi-
 zation runs 82.13
 Oil consumption per I. H. P., main engines
 only, (all purposes) 0.31 lb.
 On the first half-hour the consumption was
 0.328 pounds per i.h.p., due to the engines not
 being yet warmed up, which increased slightly

the mean consumption for the four hours.

For the total six hours the results were as
 follows:

I. H. P. main engines 4,445
 R. P. M. mean, main engines 117.29
 M. I. P. mean, both engines 85.3

It will be seen from the above that the mean
 r.p.m. is lower and the i.h.p. higher for the six
 hours than for the four hours, due to the
 greater resistance to hull in the shallower

water, as previously stated, during the latter
 part of the run. After the four-hour con-
 sumption test was completed, the power of
 the engines was increased slightly to give their
 normal m.i.p., which is 85.6 pounds, corre-
 sponding to the designed i.h.p. of 4,500 at
 115 r.p.m. with the following results:

M. I. P. mean, both engines 85.3
 R. P. M. mean, both engines 118.26
 I. H. P. mean, both engines 4,610



Observers on the trip to Boston, reading left to right—J. C. Shaw, J. E. P. Grant, Oscar Mattson, T. O. Lisle, and J. A. Wilson. Behind is Commander K. H. Donavin



Officers of the motorship "Californian," reading left to right—3rd Officer M. N. Brann, 1st Officer L. A. Ackerman, Capt. Wm. Lyons and 2nd Officer C. H. Fincke

All inner bottom tanks were filled with oil, as well as the peak tanks with water, to get the screws completely submerged. The mean draft was 13' 1½" taken in fresh water, or 12' 10" mean, corrected to salt water, which corresponds to 6,750 tons displacement. It will be noted later that her speed was higher when displacing another 1,000 tons, being over 14 knots.

After the completion of trials, the "Californian" returned to the Cramp Yard at 4:30 P. M. of May 2nd, where the post-trial examination of the machinery was made, and final adjustments to the engines were carried out. Also, the finish coating of painting was put on the engines, which had been left off until after the trials.

On Friday, May 5th, the vessel was taken over by the ship's personnel, and sailed on the afternoon of the 6th for New York to be dry-docked for cleaning and painting of the ship's bottom, which was not done before the trials. On the run to New York a four-hour consumption test was made from 6:30 A. M. to 10:30 A. M. on Sunday morning of the 7th



Electrically-driven auxiliary air-compressor in the engine-room of the "Californian"

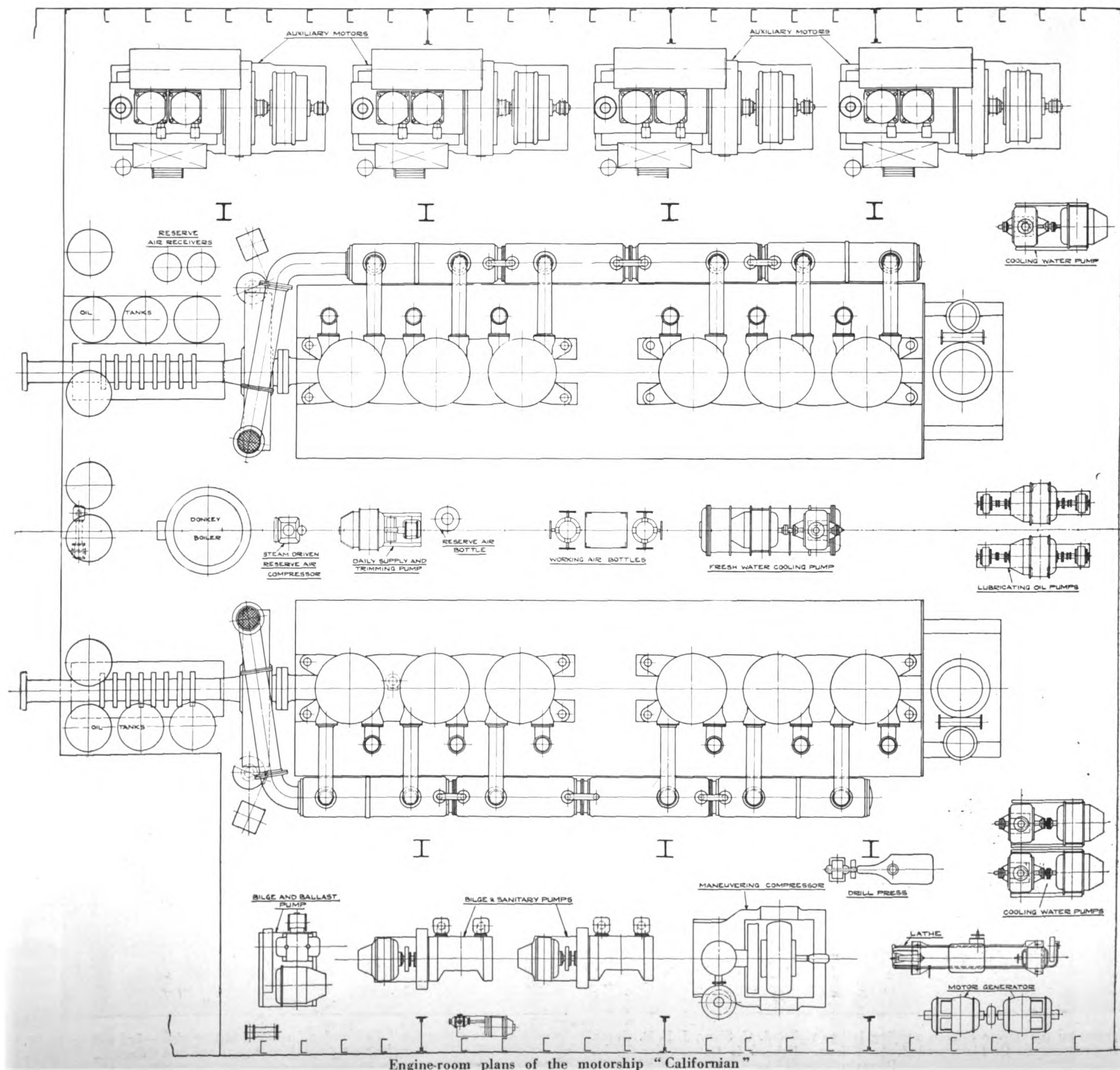
inst., with the following results:

	Port Engine	Starboard Engine	
R. P. M.	115.95	116.25	116.10 mean
M. I. P.	85.65	84.90	
I. H. P.	2,267	2,256	4,523
Total galls.			738
Galls. per hour			184.5
Lbs. oil per hour			1,400
Oil per I. H. P., main engines, all purposes			0.309

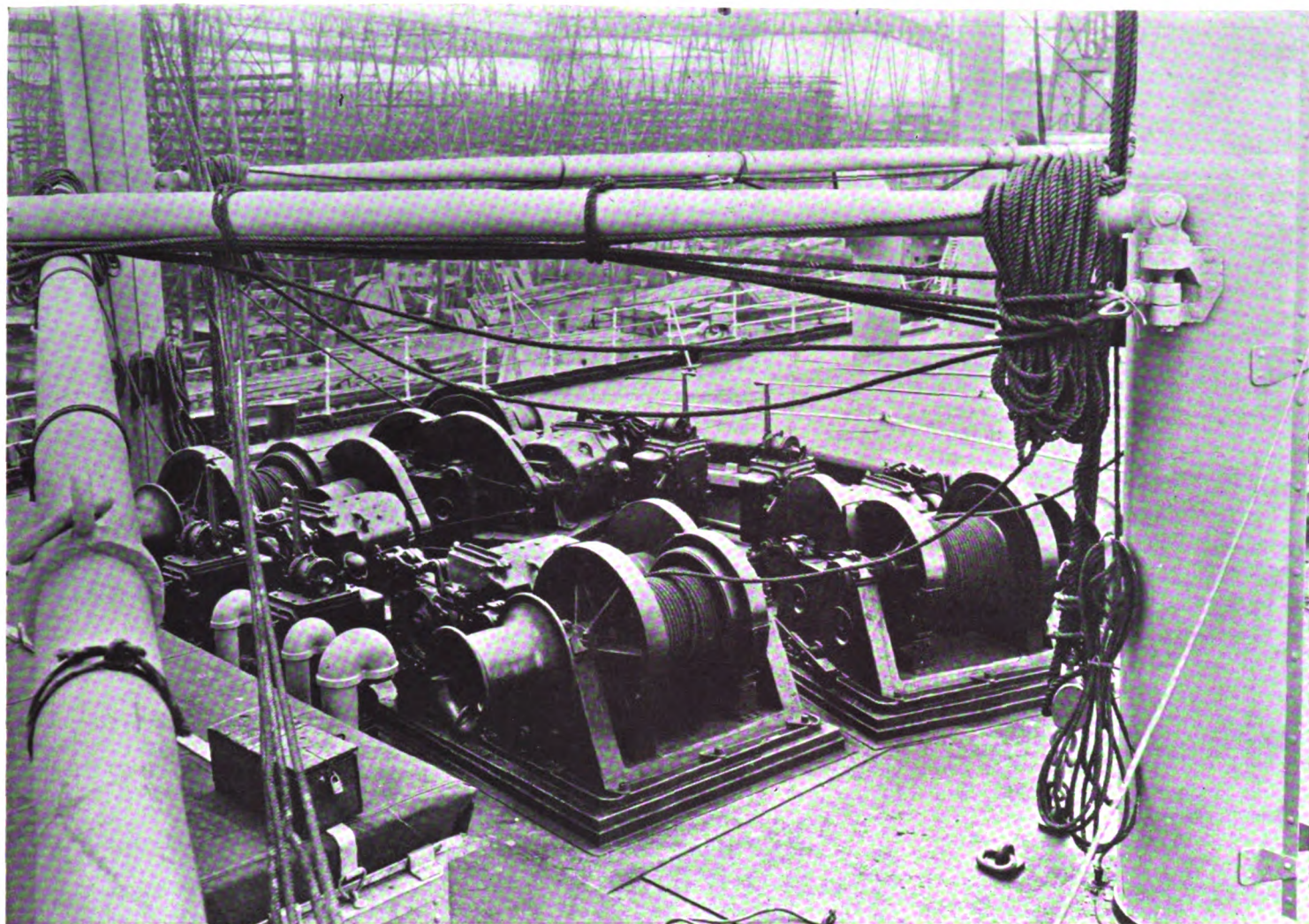
The draft of the vessel on leaving Cramp's Yard was 7' 10" forward and 18' 5" aft, or a mean of 13' 1½", which latter corrected to salt water is 12' 10", and same as on builder's trials.

All fuel tanks in inner bottom were again completely filled before leaving Philadelphia, there being a total of 9,426 barrels (1,346 tons) on board. On arrival in New York the draft was 8' 1" forward and 17' 6" aft, or a mean of 12' 9½". The oil, which was the same on trial as is being used on the first voyage, was supplied by the Texas Company and has the following analysis:

Specific gravity at 60° F.	0.913
Baumé corresponding	23.5°



Engine-room plans of the motorship "Californian"



Group of electric winches on deck of the "Californian"

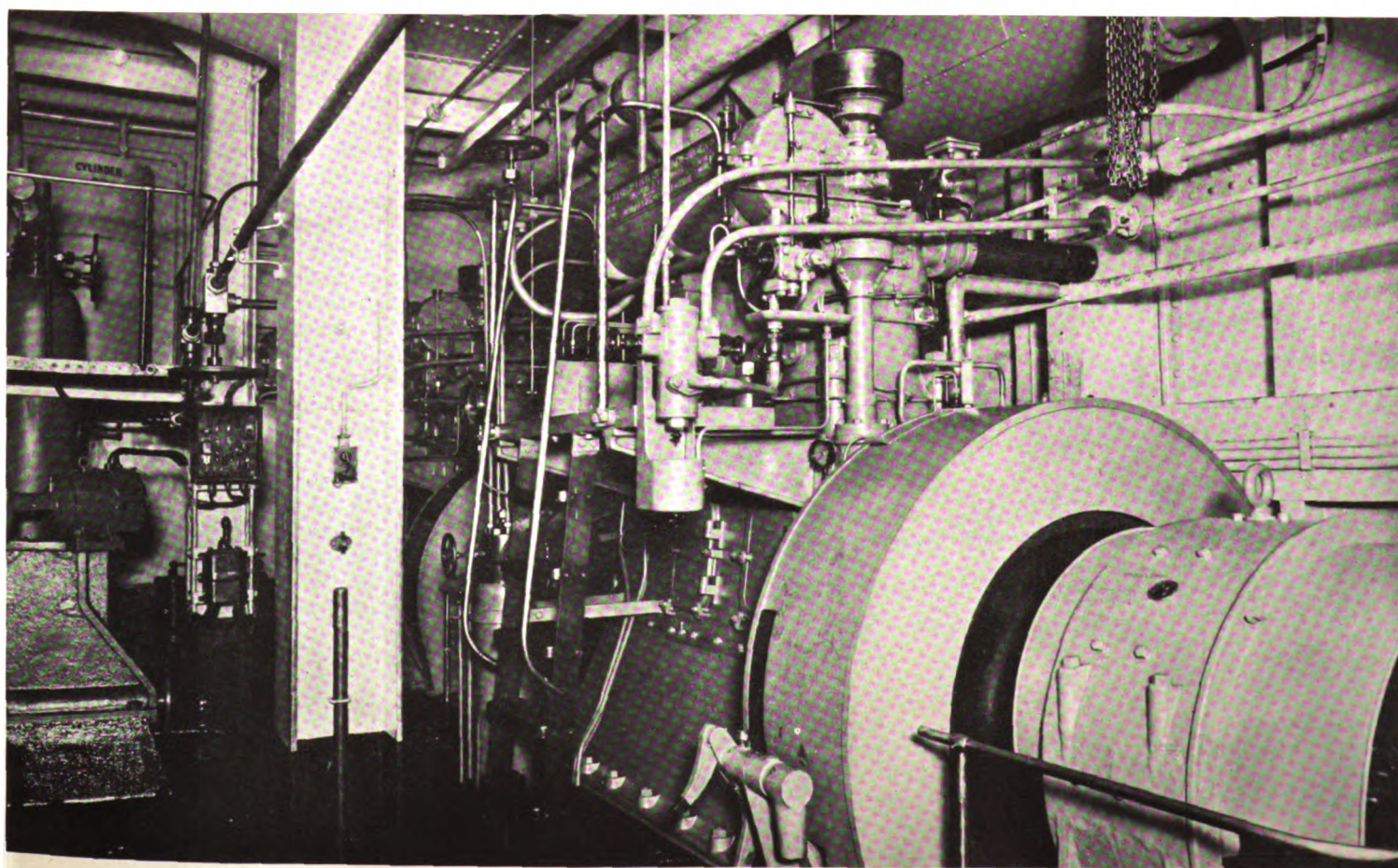
Flash, open cup	253
Fire	273
Viscosity, saybolt at 100° F.	152
Sulphur	0.60%
Asphalt, insoluble in naphtha	1.11%
B. T. U.	19,120

The performance of the machinery reflects great credit on the builders. The main Diesel engines were not run on the test stand,

as is usual with this type of machinery. Due to being a proven design, and to the great care that was exercised in the manufacture, Cramp's considered the expenditure in money and time required for a shop test not justified, which was borne out by the trials. The only adjustment required was in the fuel-cam throws, which can be quickly made, due to

these not being integral with the fuel cams proper.

The machinery is practically a duplicate of that of the motorship "William Penn," with the exception that there are four auxiliary sets instead of three, due to the larger number of winches employed than on the "Penn," and that the "Penn's" engines were built in



One of the four Cramp B. & W. 60 K.W. electric-generating sets of the motorship "Californian"

Copenhagen. All machinery of the "Californian," both main and auxiliary, was built in the Cramp shops, in accordance with the Burmeister & Wain System. The main engines are, however, in English units, and not metric, having a bore of $29\frac{1}{8}$ " and a stroke of $45\frac{1}{4}$ ". It is expected that the economy will be improved after being in service some time, when all bearings and liner surfaces are run in, and the finer adjustments are made to the fuel controls, which latter will require a short time in actual operation to complete.

It is noteworthy that no bearings were raised during the trials, nor adjustments made to same, and at all times the bearings of the main engines were cool. This is primarily due to the great accuracy exercised in the manufacture of the engines, all bearing brasses of each particular size being fitted to a common mandrel. This latter assures also absolute interchangeability, without any scraping required.

On deck the equipment consists of a Hyde electro-hydraulic steerer, twelve electric windlasses and fourteen electric hoists, having a capacity of 5,000 and 10,000 pull.

Of the opposed-ram type is the steering engine, the rams being 12" in diameter and setting athwartship forward of the stock. It is operated by a 20 h.p. motor and a No. 10 Waterbury pump, the latter being controlled from the pilot-house by means of the standard 3" diameter plunger A-E-CO telemotor. The whole gear is of very rugged construction,

mounted on secure foundations, operating the motor from hardover to hardover in thirty seconds. All of the steering-gear mechanism is stowed on the steering gear flat. The efficiency of this is particularly high, owing to the fact that the motor operates continuously and there is no heavy starting torque required. The gear is silent and free from

vibration and the losses in the system are very low, due to the fact that oil is used as a hydraulic medium through pipes of ample size. All parts are, therefore thoroughly lubricated and the wear on this type of gear is practically negligible after a number of years of operation.

The windlass is the American Engineering Company's standard electric windlass for 2-7/16" chain with 68 h.p. motor. The drive is through a heavy friction clutch of the single-ring type so arranged that any sudden strain on the cable will not damage the gear, as the clutch will slip a small amount. All of the gears and pinions have cut teeth with the exception of the main gear, which is steel half shrouded. The machine is also arranged with pump brake beams for hand operation. The motor is watertight and the whole mechanism is designed so that it cannot be damaged by sea water.

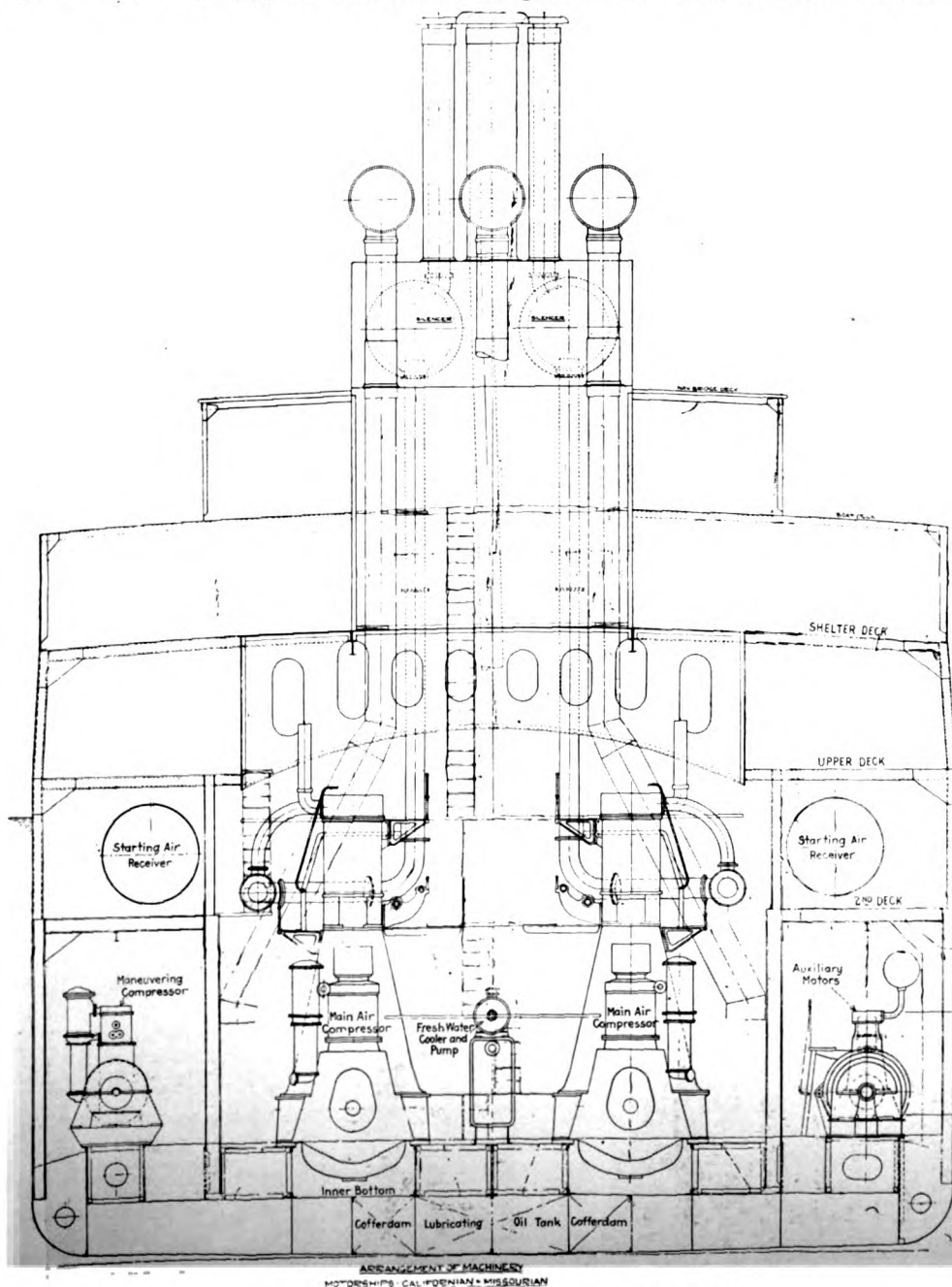
The winches are of the A-E-CO standard compound gland type and will handle loads of 5,000 pounds at 200 feet per minute, with lesser loads at corresponding higher speeds in accordance with the design of the specially wound motor so that package freight can be handled very expeditiously. By means of a clutch it can be arranged to handle 10,000 pounds load at 75 feet per minute. Six of the winches are built with the gypsy end close to the main bearings, four of them with a messenger chain wheel for operating large warping drums, two of these latter machines being forward and two at the aft end of the ship. These machines will handle cargo as rapidly as is possible in accordance with the weight of the package, and the efficiency of the loading.

The drums are 18" in diameter, 22" long and there is one gypsy head on each winch 16" diameter. On the winches with extended shafts the winch ends are 20" in diameter for quick handling of the warping cables. The motors are equipped with standard shoe-brake of the Westinghouse type, the resistance is located in a ventilated watertight casing located on the deck close by the winches, the controller being attached to this casing and the whole being operated from a horizontal lever raising to hoist and lowering to lower the load. The whole of the gear is rugged in construction and design to keep it in perfect condition and undamaged by the operation of sea water during the voyage. The gears are thoroughly guarded both for safety of the operators and to prevent the hoisting lines becoming entangled.

All of the equipment is similar both in



The A. E. C. electric windlass of the motorship "Californian"



Section of ship at forward end of the engine-room



Chief-Engr. R. H. Boyt with his Asst. Engrs. Burks, Turnage, Poling and Connal

design and size to the equipment furnished on the "William Penn," which has given such very excellent results in service. Almost all the electric motors of the "Californian's" deck machinery are of Westinghouse manufacture, while the sister motorship "Missourian" has General Electric motors; but in the engine-rooms of both ships the motors were supplied by the Diehl Manufacturing Co. Two of the winches, however, are of the internal planetary-gear type constructed by the Shephard Electric Crane & Hoist Co., while a Main Electric Co.'s warping machine is fitted for docking, indicating that there will be some active competition for the supply of electrical equipment in connection with the numerous new motorships that will shortly be laid down. The electric controls, etc., are of Cutler Hammer make. We will mention here as a guide to electric winch and other electric equipment manufacturers that there are about two dozen new large American motorships planned for early construction, about half of which are to be Diesel-electric propelled, with electrical auxiliaries. These orders will provide a very large amount of work for the firms that go after the business and maintain proper publicity. All the owners are keen readers of "MOTORSHIP."

Valuable parts of the navigating equipment are the Sperry Gyroscopic compass and the Sperry course indicator, both of which the Captain and officers are enthusiastic over. Particularly does Capt. Lyons like the course indicator, as every movement of the helm is registered on a chart. He pointed out to us that in the case of a collision it will be a simple matter to take the automatic record into court and have convincing evidence of the manner in which the vessel was navigated at

the time. The Gyroscope compass is non-magnetic and points to the true north and having no variations or deviations. This, of course, simplifies the work of the officers. It can no longer be considered an experiment because there are over 1,400 in service in the merchant marines and various navies in the world.

The general appearance of the "Californian" conveys the idea of distinction and her lines are marked by the elegance of their contour. The workmanship throughout is unequalled in modern ship construction.

The "Californian" is destined probably to make history and mark the beginning of a new decade in shipbuilding in this country. If the "Californian" and her sister ship, the "Missourian," which is soon to follow, are successful, still larger motorships may be built.

No motorship of today contains more special features for cargo space or handling equipment. The amidship accommodations have been shortened to increase the deck space to permit of an arrangement which gives the maximum number of cargo hatches and winches to be employed for rapid cargo handling. This arrangement also places the bridge in an advantageous position for the



View of deck, looking forward. Being of the flush-deck type she has an unusual amount of room for deck cargo, or the same makes a fine promenade for the crew when no deck cargo is carried

captain in handling the vessel when coming alongside of the dock. The twenty-one steel booms on the masts and king posts have been so arranged in varying lengths as to render



Faith, Hope & Charity—Deck officers: Ackerman, Fincke and Brann



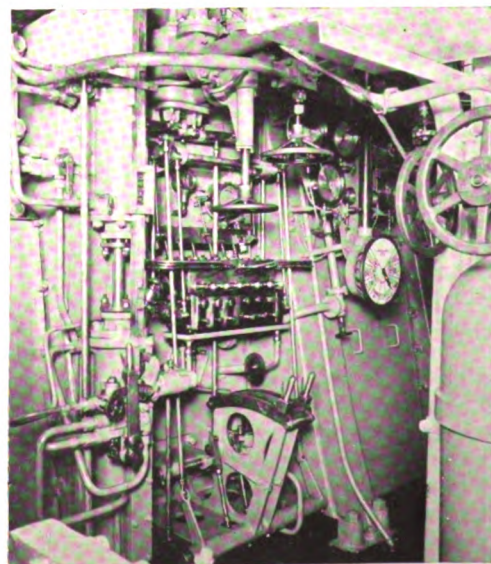
Full-speed ahead—we need to be an acrobat as well as an Editor to secure pictures of this sort

the most efficient service. Their lifting capacity varies from three to thirty tons, the longest being sixty feet.

On the deck of the "Californian" is installed the most modern cargo-handling machinery of special design. Machinery of this vessel, instead of being the most inefficient and wasteful apparatus on the ship, as would be the case if they were steam driven, will obtain their power at the same high rate of efficiency as the main propelling engines.

The main engines and auxiliary machinery were built to Lloyd's Registry, and American Bureau of Shipping Survey. The main engines consist of two Cramp, Burmeister & Wain four-cycle marine Diesel engines of the cross-head type. Each engine is capable of developing continuously 2,250 indicated horsepower when turning 115 revolutions per minute. To the forward end of each engine is fitted a three-stage compressor for supplying injection air of 850 pounds pressure.

The "Californian" has four auxiliary engines, of Cramp-built B. & W. design, having two cylinders each and directly connected to 65



Engine controls and fuel-pumps of one of the "Californian's" engines. The governor is an Aspinall, and the telegraph is of Chas. Cory make



A steel auxiliary schooner passing the "Californian" off the Connecticut shore. We will be glad to receive information about this vessel from any reader who may know her

K. W. direct current generators. For supplying salt-water cooling to the piston of the main engines and to the auxiliary engines and maneuvering compressor, three centrifugal pumps are arranged along the forward end of the engine room. Recently there has been adopted for deep-draught vessels a fresh-water cooling system for the main engine jackets and cylinder covers. This guards against getting mud or sand into the system when in muddy waters.

Oil is supplied under pressure to the main engines by two sets of two-gear lubricating oil pumps. The oil drains from the engines into settling tanks built into the inner bottom of the ship, from which it is pumped again for use through strainers. The daily supply of oil is pumped by a fuel oil transfer pump into tanks located on the forward engine room bulkhead. They are each of sufficient capacity for twelve hours' running. When maneuvering is to be done, a two-stage air compressor, driven by a 120-horse-power motor, delivers air at 350 pounds' pressure to the starting air receivers located on port and starboard sides.

For general bilge service, sanitary purposes, fire and for removing the piston cooling water, two three-throw plunger pumps have been installed. Both are used in case of fire. The ballast pump is of the wing type, with a capacity of 150 tons per hour.

J. L. ACKERSON SAYS ECONOMY OF MOTORSHIP OPERATION IS STARTLING

BEFORE the recent National Foreign Trade Convention held in Philadelphia, J. L. Ackerson, president of the Atlantic Coast Shipbuilders Association and vice-president of the Merchant Shipyard at Chester, Pa., spoke as follows of the future of the American merchant-marine: "Competition in the increasing coastwise trades will bring about a demand for more economical operation. This will be accomplished probably by obtaining new and special types and by the conversion of existing ships. Many of the ships in these and other lines active in the domestic trade are old and obsolete. Already there is much activity on the part of ship operators looking toward the building of new ships and the conversion of some of the more suitable of the Shipping Board ships.

"Diesel-ships deserve special consideration. Although there is no question regarding the exceptional economy to be obtained in the operation of these ships, American operators have been slow to adopt them. The economy of operation is so startling that, in my opinion, the change from the present accepted type of machinery to Diesel machinery will make a change in shipping which will be not unlike the change from sail to steam.

"This change in the ships in future to be built will, in my opinion, extend not only to cargo vessels, but progressively will extend to passenger ships, first with the low powered twin-screw passenger ships, and quite probably later to the larger powered ships. The results, with which all are familiar, of the M. S. "William Penn" which showed a saving of approximately \$53,000 in one trip around the world, will inspire a number of operators to demand the same economy.

For furnishing steam for heating, operating the small reserve compressor and for fire protection, a small donkey boiler of the fire tube type has been installed. The Rich fire-detecting and extinguishing or smothering system is arranged to work in conjunction with the steam system. Unfortunately the Underwriters have not recognized the merits of this system by an insurance rate reduction.

For lighting the vessel two motor generator sets of 20 kilowatts' capacity change the 220 volts to 110 volts. When the engine room is shut down completely in port, one 15-kilowatt Matthews gasoline-kerosene engine-driven lighting set, installed in a recess adjacent the upper floor of the engine room, is used for supplying light on the vessel.

When hot water is needed for sanitary purposes provision is made in the silencer house to heat salt or fresh water from the exhaust gases from the main engines.

The "Californian" is equipped with three lifeboats and one motorboat capable of holding thirty persons each.

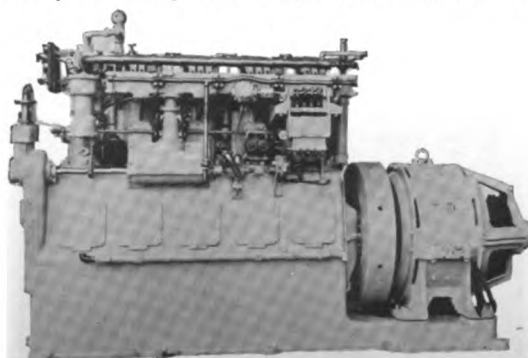
The refrigerating system, supplied by the Brunswick Refrigerating Company, is of the Brunswick direct expansion ammonia type, with a motor-driven compressor of two-ton capacity.

For the wireless the Telefunken system is installed and the set is in charge of Frank Heinfling, who has been six years with the American-Hawaiian Steamship Company. There is a 3 k.w. spark transmitter, and a crystal receiving set, also a Audium set for the reception of long distance arc and spark signals. The transmission and reception of signals during night time can be made practically across the ocean and the vessel is always in communication with land under favorable conditions. As is now well known, the sun's rays affect the wireless in the day time and a set can transmit five times the distance at night. It is very interesting to hear

DIESEL AUXILIARY-GENERATORS ON PASSENGER-LINERS

DECIDED interest has been recently shown in the use of auxiliary Diesel-engine driven electric generating sets on board the larger ocean-liners as an additional safety-feature in case of serious accident to or failure of the steam electric-generators located in the engine-room. In the event of the flooding of the engine or boiler-rooms the steam-driven units are put out of action and the ship is left in darkness. By locating an auxiliary generating-set high up above the water-line a complete emergency lighting-system can be provided which is always ready for instant use and which no accident to the ship can put out of order. On some passenger-liners gasoline-driven sets are fitted, but these are harder-starting and do not govern as well as the Diesel-driven set. Gasoline is not as safe for use as fuel-oil and where these electric-sets are located in a deck-house high up among the passenger-accommodations this point must be borne in mind as well.

In reconditioning the "Leviathan" the safety-feature provided by a Diesel-driven set



A Winton-Westinghouse Diesel-driven electric set of 60 K.W. for ships' emergency equipment



One of the American Engineering electric winches on the "Californian"

the wireless telephone that was being broadcast by the Westinghouse Company of Pittsburgh. At sea voices could be clearly heard.

On board the "Californian" on the trip to Boston, as observers were Commander K. H. Donavin, Assistant Operating-Manager of the Atlantic Transport Line; J. A. Wilson, Chief Surveyor of the United States Salvage Association; J. C. Shaw, Assistant Chief Engineer of the Cramp Shipyard; J. E. P. Grant, Chief Engineer of the Merchants' Shipyard, and Thos. Orchard Lisle, Editor of MOTORSHIP. Oscar Mattsson accompanied the vessel as Guarantee Engineer for Cramp's. It may be remembered that Mr. Mattsson was guarantee engineer on the "William Penn" on her record voyage around the world. Previously he was chief engineer of the motorship "George Washington" when she was chartered for two voyages to the Far East by the United States Shipping Board.

The performance of the "Californian" on her voyage to the Pacific Coast and to Europe, as well as the forthcoming voyage of the sister ship "Missourian," will be watched with great interest by shipowners, but we have not the slightest apprehension but that both vessels will even put up finer voyages than that of the "William Penn."

has been recognized and the specifications call for two Diesel generating-sets thirty feet above the water-line with complete independent equipment, switchboard, etc., of sufficient capacity to take care of the emergency lighting as well as furnishing power for the wireless-telegraph in emergency. This means that, instead of a ship being unable to send out messages after the fires in the furnaces are drowned-out as she sinks, the lives of the passengers and crew will be protected through the ability to send out and receive messages until the whole ship is under water. This would give opportunity for the life-boats to be loaded under the light these provided.

The Winton Engine Works, with their long experience in the application of the Diesel-engine to generator-service, have recently developed some smooth-running units which operate practically without vibration, govern well, start instantly and follow generally the fourteen three-cylinder, four-cycle 7½ in. by 11 in. direct-connected 25 KW. sets which these manufacturers furnished to the U. S. Army Transport Service. These units will handle a 40 KW. generator at 450 r.p.m. Other units of the same bore and stroke of 60 KW. capacity in four-cylinders and of 90 KW. capacity in six-cylinders have been put in service.

The latest Winton Diesel generating-sets developed for emergency-lighting is a 32 KW. four-cylinder 5½ in. by 7 in. set operating at 650 r.p.m. which operates quietly and is safe.

A GOOD RECORD

Up to the end of March last the new North Eastern-Werkspoor Diesel-engined motorship "Segovia" had run 11,738 nautical-miles on a total of 234 tons of fuel-oil, or 3½ tons per 24 hr. day. She is a single-screw vessel of 1,400 I.H.P. at 120 R.P.M.

America's Largest Diesel Motor-Yacht

"MOTORSHIP" has recently published many descriptions of new Diesel motor-yachts and of crafts of this type in which Diesel-engines have replaced other propelling power. We believe that the almost universal adoption of the Diesel-engine for large yachts is now an assured fact. One of the chief reasons for its adoption is the very long cruising-radius which oil-engine power affords as well as the economy of operation itself. Another is the safety factor, due to less danger from fire. Many have seemed to hold the opinion that very wealthy men can afford to pay the high-cost of gasoline for propelling their yachts and are not therefore anxious to discard gasoline power for the more economical Diesel-engine. However, the facts of the case are that the very wealthy yachtsman is adopting the latter power partly because of the very ability to economize. The demand today for motor-yachts is for seaworthy, comfortable and fast craft of less first-cost per cubic-foot accommodation space than the pre-war steam-yacht and the yacht-owner to-day sharpens his pencil and figures the cost of operation as well. These factors account for the increased use of the Diesel-engine in the pleasure-fleet.

Among those now under construction the largest is the "Dolphin," which is building from designs by and under the supervision of Cox & Stevens of New York by the Newport News Shipbuilding and Dry Dock Co. for a prominent yachtsman whose name has been withheld. Delivery will be made early in the Summer. This attractive twin-screw motor-yacht, illustrations of which we are able to publish through the courtesy of the designers, will be the largest full-powered Diesel-engined pleasure-craft in this country and the second largest in the world. The principal dimensions are:

The "Dolphin," Now Building by the Newport News Shipbuilding and Dry Dock Co., Will Be the Last Word in Pleasure Vessels

Length over all.....	180 ft. 0 in.
Length water line.....	170 ft. 0 in.
Breadth	24 ft. 0 in.
Draft	9 ft. 0 in.
Horse Power	1,000 h.p.

She will be suitable not only for coastwise cruising, but will be a splendid sea-boat possessing a cruising-radius of 6,000 miles at a speed of 16 miles per hour. This speed will be possible because of the installation of two 500 brake h.p. eight-cylinder four-cycle Winton Diesel-engines operating at 250 r.p.m. Yachtsmen are familiar with this type of en-



The new Winton Diesel-engined yacht "Dolphin"

gine in view of the installations in the "Nourmahal," Mr. Vincent Astor's fine full-powered yacht, the "Hussar III" owned by Mr. E. F. Hutton, the "Guinevere" owned by Mr. Edgar Palmer, the "Elfay" owned by Mr. Russell A. Alger, Jr., the "Marold II" owned by Mr. C. Harold Wills, and others. These engines are compact, relatively simple in design and construction, and after a short training can be operated by the ordinary engineer such as usually found on yachts.

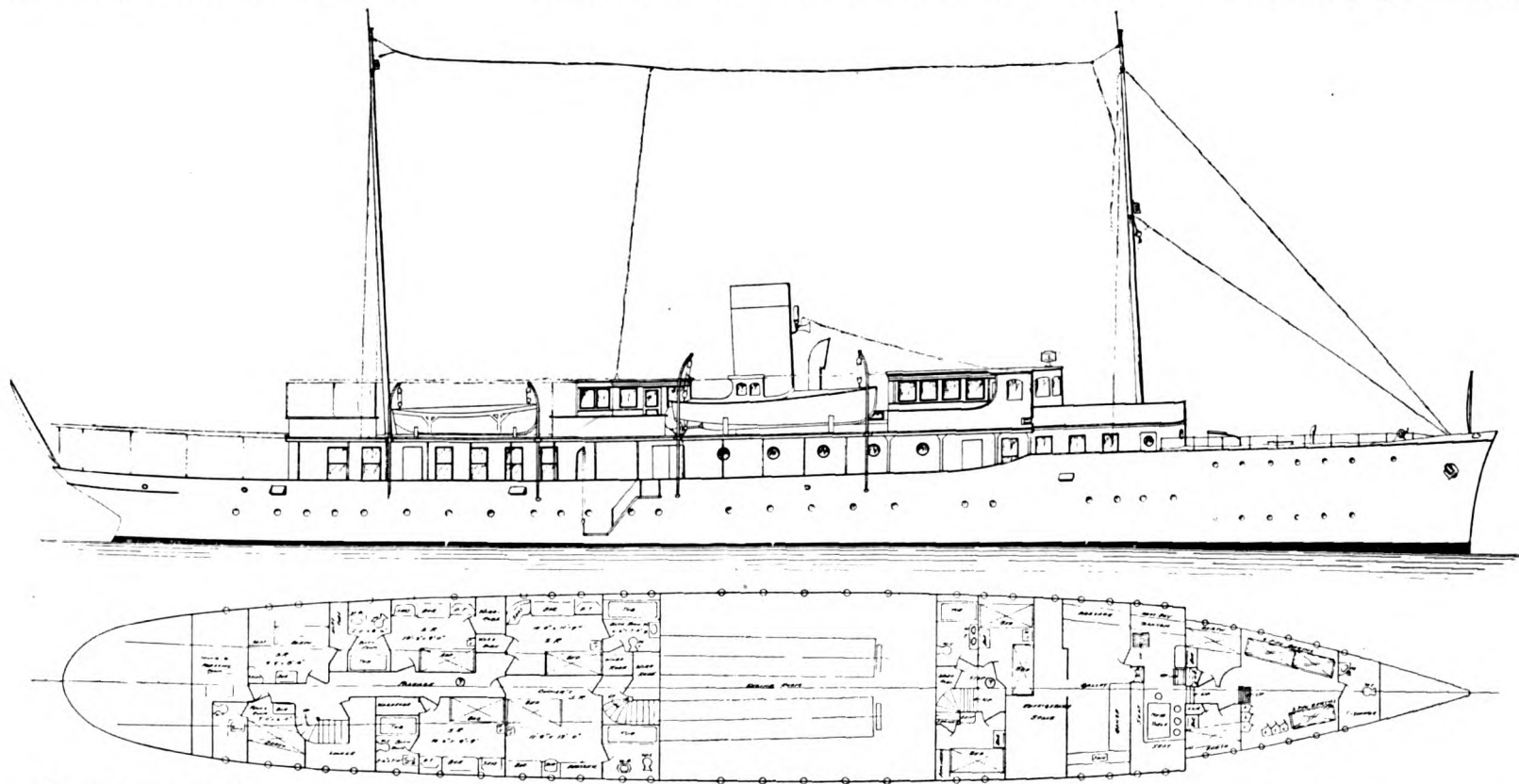
While at this writing we are unable to give a description of the auxiliaries being installed, we understand that these include an unusually

powerful electric-lighting set, cold-storage plant, forced-ventilation system, electric-windlass, steering-engine, wireless-equipment and boat-hoists. A hot-water cabin-heating system with forced-circulation is also provided. The hull is of steel, of extra heavy scantlings, the model is sweet and clean-lined, the freeboard ample to permit her to face any weather. The deck-house is of steel and contains the large dining, breakfast, smoking and living rooms. Every comfort is provided and every desire anticipated. Below decks are to be found conveniently laid-out accommodations for the owner's and guests' rooms.

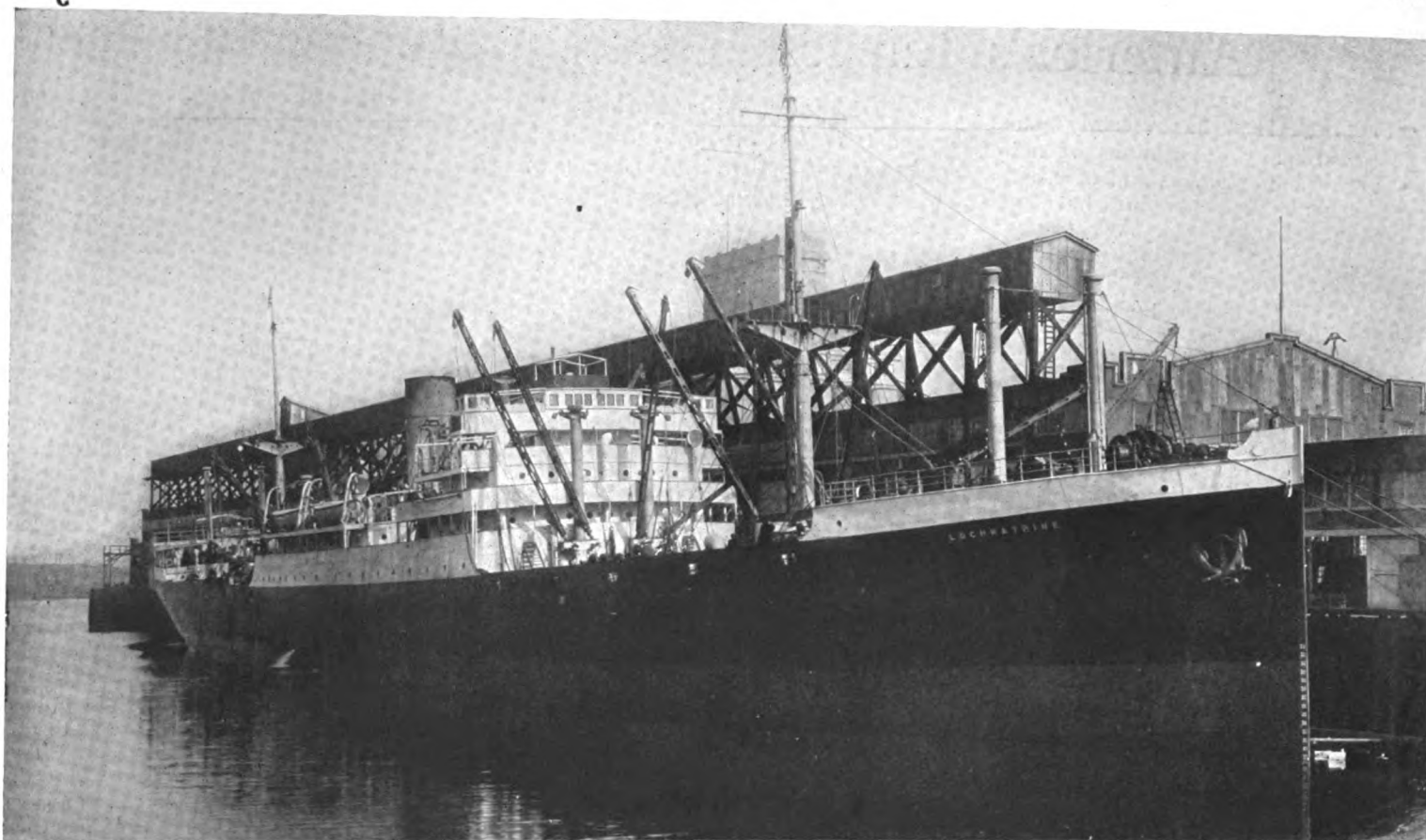
Particular attention is called to the fact that the amount of space occupied by the two large staterooms with adjoining baths shown just aft of the engine-room would be occupied by engine-room in a craft of this size powered with a steam-plant. Not only is accommodation for the owner increased in the motor-yacht as compared to the steam-yacht, but the nuisance of bunkering more often and the additional quarters otherwise required for firemen favor the Diesel motor-yacht. The "Dolphin" will carry less than one-half the crew which a steam-yacht of this power would carry, and the operating cost will be about one-third. There is no necessity for a smokestack, as hollow masts can be used for the exhausts, so full deck-room can be secured for the promenade. Finally, there are no smoke and cinders to annoy the owner and his guests.

MOTORSHIP "PELICAN" HAS DIESEL-ELECTRIC DRIVE

Regarding the new Diesel-driven submarine mother-ship "Pelican" referred to in a recent issue as building in Holland for the Dutch Colonial Department, we have been advised that she is Diesel-electric driven. Two Schelde 700 b.h.p. Diesel-engines each drive dynamos, which in turn furnish current for two electric-motors of 750 shaft h.p. each that are coupled to the twin propeller-shafts.



General arrangement plans of the Cox & Stevens designed Winton Diesel-engined motor-yacht "Dolphin," now building at the Newport News Shipbuilding & Dry Dock Co.'s plant. She was launched on April 8th and is the second largest Diesel-driven yacht in the world, Wm. K. Vanderbilt's "Ara" being the biggest and highest powered



The motorship "Lochkatrine" at Seattle, Wash.

Motorship "Lochkatrine's" Huge Cargoes

COMPLETING an extremely successful maiden voyage of over 7,500 nautical miles, the Royal Mail Steam Packet Company's new motorship "Lochkatrine," one of the biggest motorships so far built in the world, arrived at Seattle, Wash., Tuesday morning, April 11th, having brought through the Panama Canal what is claimed to be the largest cargo that has been carried from Europe through that waterway since its construction. This cargo included 15,000 cases of whiskey for Vancouver, B. C. The vessel loaded part of the new cargo at Seattle and proceeded to Vancouver where she arrived on April 15th, for completion of the discharging and final loading, and is now returning to Dutch & British ports. Owing to her economy of operation and her consequently low freight rate, she will be one of the few big ships to sail for some months from the Pacific Coast to Europe with a full cargo and all her passenger accommodation booked.

We have frequently referred to this fine vessel as being the first of six of a standard type of 14,000 tons d.w. ships which the R.M.S.P.Co., and their associates, the Holland-Amerika Line, are building for the run from the United Kingdom and Dutch ports to the Pacific Coast of North America. A sister motorship, the "Dinteldyk" is now following her on this run and the others are nearing completion, while the Glen & Elder Dempster Lines have five motorships of similar dimensions between them.

The "Lochkatrine" is a splendidly built twin-screw motorship with many noteworthy features, being designed for a special long-distance run in which large refrigerating space was required. She also has limited, but excellent passenger accommodation. She is a two-masted vessel with nicely balanced superstructure amidships, set-off by a large stack in which the exhaust silencers are installed. She was built by John Brown & Co. at Clydebank, from Harland & Wolff's designs, the latter firm building her Burmeister & Wain four-

New British Diesel-Driven Liner of 19,000 Tons Displacement Brings 11,000 Tons Cargo Underdeck Through Panama Canal on Maiden Voyage and Returns to Europe Fully Loaded With American and Canadian Products

cycle Diesel type engines, each with eight single-acting cylinders 740 mm. (29.134") bore and 1,150 mm. (45.276") stroke, designed to work at 115 R.P.M. The combined output of the two engines at this speed is 6,400 ind. h.p. and higher power can be developed at slightly increased engine speed. In fact, on the run across the Atlantic they at times developed 7,000 i.h.p.

The "Lochkatrine" is in command of Captain R. G. Matthews who has served twenty-two years with the Royal Mail. Her Chief-Engineer is C. J. Helps who is also an old Royal Mail man. The vessel carries a total crew of 68 men, including thirteen engineers, three of whom are electricians and one a refrigeration engineer. Including oilers there are 24 men all told in the engine-room. Also, there is a guarantee-engineer on board for this trip. She is fitted with considerable refrigeration capacity, which enables her to carry fruit and other perishables from the West Coast around to England and the continent, the total cargo space under deck being a maximum of 12,000 tons of weight cargo or 11,500 tons of normal cargo in the 657,540 cubic-foot space, in addition to 744 tons of cargo in the deep tank, making a total capacity of 683,630 cubic feet. Because of the low consumption the deep-tank can be used for oil-cargo or dry-cargo even on long voyages. The refrigeration capacity is 92,000 cubic-feet or 2,296 tons.

She has spacious accommodation for twelve passengers, and when she left the Pacific Coast she inaugurated the first direct passenger

service from Seattle via the Panama Canal to the British side of the Atlantic. Her net-cargo around from London consisted of 11,000 tons in addition to fuel, water and stores, said to be the largest cargo ever received on the Pacific Coast from the other side of the Atlantic. And she will carry an equally large cargo on her return, as her space was fully booked. In fact, much cargo has been turned down. With scores of steamships laid-up on the coast for lack of cargo at profitable rates, the fact that the "Lochkatrine" turned down cargo on both the Pacific Coast and London is poignantly significant of the economy of the motor vessel as compared to the steamship.

No expense was spared in her construction as will be realized from the description of her equipment which follows presently, and she was ordered at the peak of shipbuilding prices. The Shipping Board, when this and her five sisters were building, considered that because of the high cost of these motorships American steamers would have no difficulty in competing with them. But we presume the Board's experts fell into the usual error of comparing them with steamers of equal dimensions, but of lesser underdeck cargo capacity instead of with larger steamers of equal cargo and sustained sea-speed performance. We will repeat the dimensions of the "Lochkatrine" class of motorships together with the consumption, etc.:

Loaded displacement	19,164 tons
Underdeck net-cargo capacity not including fuel, water and stores ...	683,630 cubic ft.
Refrigerated-Cargo Capacity	92,000 cubic ft.
Loaded speed	12½ knots
Daily fuel-oil consumption	20 tons
Daily lubricating-oil consumption	10 gallons
First cost	£690,000* (\$3,036,000)
No. of passengers	12
Total officers and crew	68

* Ordered at peak of shipbuilding prices.

These are the factors that count with any freighter, the dead-weight capacity being absolutely misleading for steamer and motorship comparison purposes. Her cost, if the above price is correct, figures-out at \$4.03 per

cubic foot of underdeck cargo capacity, and she is an exceptionally high-grade liner with a trial speed of $13\frac{1}{2}$ knots and a sea-speed of $12\frac{1}{2}$ knots. A steamer would have to be of 21,000 tons loaded-displacement and of about 7,500 i.h.p. to maintain the same speed and have the same cubic capacity for cargo on a similar long-distance voyage, which means large overall dimensions, so that the first cost of the steamer would be just as high if ordered at the same time. The crew consists of 68 men only, because of the absence of firemen. Several additional men would be saved if there were no passenger accommodation, the expense of operating which is more than covered by the fares. The cost of 7 of the Shipping Board's State class 502 ft. steamers, which are about the same size, averaged \$4,086,349 each, or considerably more than the "Lochkatrine."

The balance of the "Lochkatrine's" dimensions are as follows:

Length O. A.	502'0"
Length B. P.	485'0"
Breadth M. D.	62'0"
Depth M. D.	39'6"
Draft (Mean loaded)	29'6"
Light Displacement	7,230 tons
Cubic-capacity of holds	657,540 cu. ft.
Cubic-capacity deep-tank (cargo) ..	26,090 cu. ft.
	or 774 tons
Refrigeration capacity	92,000 cu. ft.
	on 2,296 tons
Fuel-bunker capacity (double-bottom) ..	1,200 tons
Fresh-water carried	334 tons
Cruising radius	18,000 nautical-miles
Daily fuel consumption	20 tons
Port-fuel consumption (when handling cargo) ..	$\frac{3}{4}$ ton
Date placed in service	Jan. 21, 1922
Total crew	68 men

Regarding her maiden voyage, the "Lochkatrine" left Glasgow on Jan. 22nd, proceeding to Rotterdam and Antwerp, at which ports she picked up 7,000 tons of general cargo. Then she went to London and loaded the balance of 4,000 tons, making 11,000 tons in all. Leaving London Feb. 15, she made a non-stop run to Colon, Panama. This section of the run was made with 26'8" draft. During the trip from London to Colon, of 17 days, there was no stop of the main engines although almost throughout crossing the Atlantic there were heavy seas and strong headwinds. The distance covered was 5,418 nautical-miles. The following is a résumé of the complete voyage to the Pacific Coast.

Run	Distance (Naut. Miles)	Average Speed (Knots)
London to Colon.....	5,418	No record at hand
Colon to Puntarenas	284	11.5*
Puntarenas to San Pedro....	283.3	12.0
San Pedro to San Francisco.	403	11.5
San Francisco to Astoria....	673	12.0
Astoria to Portland & return	190	13.5**
Astoria to Seattle.....	283	11.4

* Against a 2-knot current.

** With and against current of river.

At Puntarenas a consignment of coffee was taken on board, while at all the American ports cargo was discharged. At Astoria and Portland 2,000 tons of grain and canned salmon were loaded, while at Vancouver she loaded grain and general cargo, as well as fresh salmon in her cold storage section.

On the run from Astoria to Seattle very heavy weather was encountered, the propeller slip being 25.3 per cent. Unfortunately, our representative did not secure the speed of the vessel from London to the Canal, which was made in about 17 days.

It will be noted that the lubricating-oil consumption is given as 10 gallons per day. While this seems astonishingly low for engines of such high power, it is according to the records of the ship, and no error can be detected that alters it.

The fuel used on her maiden voyage was Diesel-oil of 26 degrees Baumé, purchased from the Asiatic Petroleum Company of London. The consumption of 20 tons per day in-

cluded the fuel-consumption of both the main engine, auxiliaries, and refrigerating machinery, as well as the donkey-boiler for heating the ship in the winter weather.

In addition to the main motors there are four Allen-Burmeister & Wain Diesel-electric generating-sets, each of 100 K.W. in 220 volts, which furnish power for all the electric winches, steering-gear, windlass, and for two 180 h.p. electric-driven auxiliary air-compressors, as well as the various pumps, refrigerator and other machinery.

We understand that the ship was designed with unusually solid engine foundations, and the Chief says that she is built as solid as a battleship, having transverse web frames and longitudinal stiffeners which give great rigidity. The main engines are constructed with steel columns extending from the bed-plates to the top of the cylinders, in addition to the cast-iron frames. The engines ran excellently on the maiden trip, all the valves standing-up well, repairs being almost negligible, but some difficulty was experienced in replacing a cylinder-liner which was accidentally dropped and broken, but one was finally secured from the Bethlehem Steel Works. Our information does not show whether this was a spare liner or whether one of the liners was being removed from a cylinder for some reason.

Contrasting with the B. & W. type Diesel engine built by Cramp's Shipyard in the United States, fresh water is used for piston-cooling and sea-water for cooling the cylinder jackets of the main engines. With the Cramp B. & W. engine the salt-water is used for the pistons, and fresh-water for the cylinders.

On an upper platform in the engine-room is the refrigerator machinery. Two refrigerator compressors, each direct driven by a 42 h.p. Scott electric motor running at 90 R.P.M., take care of the 2296 tons of refrigerator space. There are eight refrigerating chambers, besides which No. 3 hold can be cooled by circulation of air and kept at a temperature of 25-40 degrees Fahrenheit. A 10 h.p. motor works on a shaft extending into the refrigerator space, where it operates a fan. There are also 3 brine pumps of 10 h.p. running at 1,100 to 2,100 R.P.M., while a circulating-pump for cooling the condenser-coils is driven off the refrigerator machinery.

The "Lochkatrine" has two steel pole masts and twelve pairs of derrick posts carrying 36 cargo derricks. Two derricks for heavy lifts are rigged on the masts, the one on the foremast being tested to 35 tons. There are four big MacFarlane winches with a lift of 20 tons, fitted with 50 h.p. electric motors. They have four separate barrels on each horizontal spindle, each barrel being operated by a single lever. There are also eight 7 ton winches of Wilson type driven by 35 h.p. motors working at 450 to 675 R.P.M. Capt. Matthews says that while the winches are a little slow yet on account of being new, and the longshoremen in many of the ports not being used to handling this type, yet the longshore crowd at San Pedro did some very smart work getting out cargo with them.

The windlass is driven by a 85 h.p. electric motor located below deck, operating the windlass by a vertical spindle and bevel gear, the motor speed being 270 to 400 R.P.M.

The vessel is one of the most completely equipped that ever came into a Puget Sound port. Phones connect with bridge from every part of the ship. Indicators on the bridge ring if one of the vessel's mast or bridge lights go out and indicates which light became extinguished. A Morse signal-light on top of the foremast is operated from the bridge. A direction-indicator tells whether the engines are going ahead or astern in case the engine-room mistakes a signal and an electric tell-tale shows how many degrees the rudder is to port

or starboard. The chartroom is equipped with the submarine signalling system, and instrument showing the degrees of list to starboard and port and every conceivable instrument to aid navigation. The accommodations are also very fine, with smoking-room, dining-hall, officers and passengers' quarters, all finished in white and mahogany.

* * *

MOTORSHIP "HAURAKI" CALLS AT SAN FRANCISCO

A LENGTHY article on the trials of the Union Steamship Company of New Zealand's new North British Diesel-engined cargo motorship "Hauraki" was given in the May issue of MOTORSHIP. She arrived at San Francisco on April 25th on her maiden voyage from Glasgow, and one of our San Francisco representatives went aboard. She discharged her cargo of coal and then made a round trip to Vancouver, B. C. and back before starting on her regular route to the Antipodes. David Todd is the master of the vessel, and J. Scrivener the chief mate. W. Gollan is the chief engineer.

"Fine as a top" was the comment of the Chief to our representative of the trip which was made on an average daily consumption of 14 tons of fuel-oil and 12 gallons of lubricating-oil. Although only expected to do 12.5 knots, she made 13 on her trials and averaged 11 knots on the voyage, which was taken easily without attempt to open the engines up to full-speed except for short periods. Opportunities to test her speed with one engine only showed that she made 8 knots steadily and steered like a yacht.

The voyage from Glasgow of 9,724 nautical miles took 39 days, including two days stop at Tampico, Mexico, and a day in Colon harbor at the Canal Zone, but no other stops took place.

Her leading dimensions are as follows:

Length (O. A.) ..	466 ft., 0 in.
Length (B. P.) ..	450 ft.
Breadth (Moulded) ..	58 ft.
Depth (Moulded) ..	34 ft.
Loaded Draught (Mean) ..	27 ft. 6 in.
Displacement (Light) ..	5,300 tons.
Dead-weight-capacity of Ship ..	10,600 tons.
Total cubic-capacity below deck ..	619,000 cu. ft.
Cubic-capacity of Deep Tank ..	59,400 cu. ft.
Weight capacity of Deep Tank ..	1,578 tons—oil.
Capacity of Fuel-bunkers (double bottom) ..	1,132 tons of oil or 1,741 tons S. W. ballast.
Total Fresh-water Carried ..	484 tons.
Cruising Radius ..	13,000 miles.
Shaft Horse-power ..	3,500 H.P. for 2 shafts ($\frac{1}{2}$ on each).
Indicated Horse-power ..	4,560 i.h.p.
Ship's Trial Speed ..	12.5 knots.
Ship's Speed (Loaded) ..	11.5 knots.
Propeller, Dia., Pitch and Area—Dia., ..	15 ft.; pitch, 14.7; area, 66.3 sq. ft.; 3 blades.
Daily Fuel-Consumption (actual if possible with ship fully loaded) ..	14 tons this trip.
Daily Lubr.-oil Consumption ..	12 gallons.
Number of Engine-room and Boiler Staff ..	9 engineers 10 motormen.
Daily Fuel-consumption in Port ..	1 ton.
Total Cost of Ship (including engines and boilers, etc.) ..	\$700,000.
Type of Engines (Diesel) ..	North British Diesel Engine Works, Ltd.
Cylinder Bore, Piston Stroke ..	26 $\frac{1}{2}$ in. by 47 in.
Weight of Main Engines (with thrust-block, but without propeller and shafting) ..	268 tons.
Type of Deck Machinery ..	McFarland-Perry winch (electric driven).
Length of Machinery Space ..	56 ft. 3 in. d. b. unused.
Name of Owner of Ship ..	Union S. S. Co. of New Zealand.
Name of Builder of Ship ..	Denny & Co., Dumbarton.
Name of Engine Builder ..	North British Diesel Engine Works, Ltd.
Date Put in Service ..	March 17, 1922.

Considerable interest was shown in the "Hauraki" by San Francisco shipping men here, and several steamship company superintendents inspected her. She has sister engines to the "Domala," differing chiefly in that the compressors are on the main engine, whereas the "Domala" has separate compressors. The "Hauraki's" total fuel capacity is 2901 tons (specific gravity 0.93). Her total cargo capacity of 619,000 cu. ft. is divided up as follows: holds, 335,900 cu. ft.; shelter 'tween decks, 137,800 cu. ft.; lower 'tween decks, 145,300 cu. ft. This huge capacity should be compared with that of a steamer of similar dimensions and displacement.

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AMERICAN SHIPPING MEN AND THE MOTORSHIP TO-DAY

HOW different is the attitude of shipping men of to-day from the doubt or almost distrust of the motorship which they displayed several years ago. It is interesting to note that many of the leading American steamship-owners and steamship builders are now as enthusiastic for Diesel propulsion as ourselves, and a number of them are coming forward with voluntary public statements on the subject. "Sell 200 to 300 Shipping Board ships at \$5.00 per ton for the purpose of permitting conversion into Diesel-driven vessels, and the Board will be rid of a great many ships which otherwise could not be sold at any price whatever," said Frank C. Munson, president of the Munson Steamship Line, New York, before the Joint Congressional Committee on the Merchant Marine on April 28th. "It will have given work to the American shipyards and repair yards, and it will also have been an incentive to American inventive genius to produce better types of Diesel-motors and propelling-machinery which will put American ships in a position to readily compete with the increasing number of foreign Diesel-motored ships being turned out." Continuing, Mr. Munson said: "One of the greatest opportunities of the Shipping Board to dispose of some of its less efficient steamers is going to be for conversion purposes. I am a great believer in American inventive genius, and the conversion of ships into Diesel propulsion is going to be one of the big things in the future, and the shipyards which first realize that by employing Diesel experts and by experimentation with Diesel motors are going to increase their own business to a large degree and are going to be great gainers in real business."

Commenting upon Mr. Munson's contentions the "Nautical Gazette" in a recent issue states that "he is quite right in saying that we should adopt the most improved methods of marine propulsion for our merchant-men. By following this course we would ultimately attain supremacy at sea, a result which we can never hope to achieve by subsidizing worthless and inefficient vessels." In the same magazine Mr. J. H. Mull, President of the Wm. Cramp & Sons Ship & Engine Building Company, said that "Among shipping men, it has been known for a long time that the condition of numbers of the Board's ships is such that they will never be placed in service, and the problem confronting us today is what disposition can be made of this ineffective tonnage. Those most suitable should be equipped with proven type Diesel engines. There are comparatively few ships that could be so reconditioned effectively, possibly about one hundred, but they would form the nucleus of a merchant marine which would be a power to be reckoned with in the race for the world's commerce. There is no doubt," said Mr. Mull, "but that the Diesel-driven ship will be the vessel of the future for the long distance trade, and this is a condition which we must take into consideration. In this country there is an unmistakable prejudice against the Diesel engine, and our shipowners are somewhat reluctant to adopt them. But this does not alter the fact that foreign shipping men are operating and building Diesel driven vessels, and that this is the type of vessel with which we shall have to compete in the future. We can argue against the reliability of the Diesel engine to our heart's content, but our arguments will not stop the foreigner from installing them in his vessels, and we must make up our minds to the fact that unless we adopt a similar course we shall be left behind. The Diesel engine has proved itself, and its economical operation and reliability cannot be disputed."

"So thoroughly convinced was the William Cramp & Sons Ship & Engine Building Company of the advantages of the Diesel engine that it was willing to back its judgment by purchasing at its own expense and risk one of the idle ships of the Shipping Board for the purpose of replacing its present steam machinery by a high-grade Diesel instal-

lation; this vessel to be disposed of to private owners on the completion of the work. The growing popularity of the Diesel engine abroad has created a condition in the shipping industry which must be met by this country, and although we have thousands of tons of useless ships, it would be a splendid thing for our merchant marine if the better ships included in this tonnage could be converted into Diesel-driven vessels."

WHAT AMERICANS CAN DO

IN the opening pages of this issue complete details are given of the first of the two new motorships of the American-Hawaiian Steamship Company. It has been erroneously claimed that Americans can neither construct or operate vessels of this class successfully, but in reality nothing could be farther from the truth.

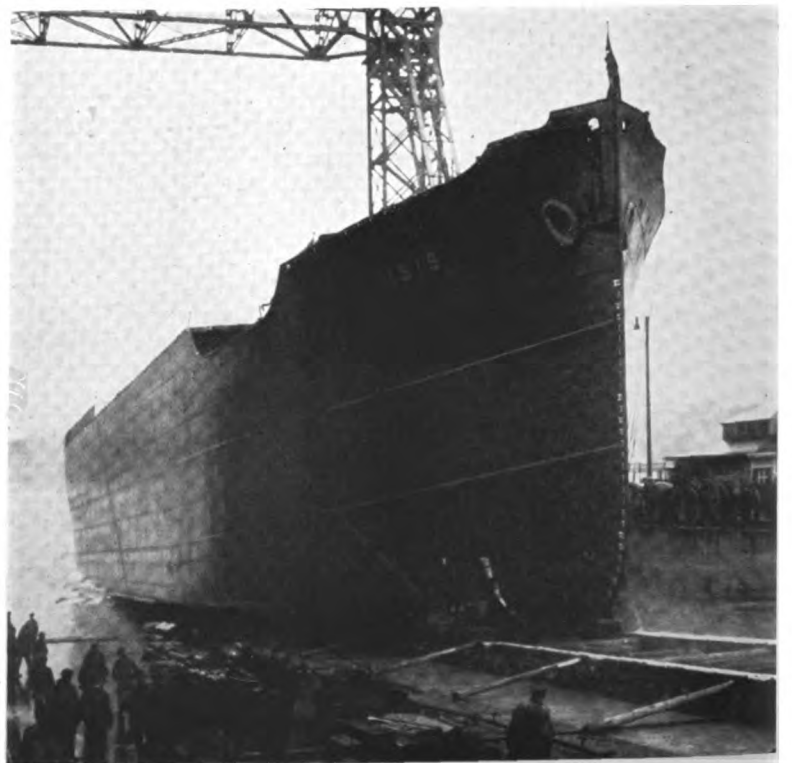
The high-powered Diesel-engines of this vessel are the first of their type to be constructed in the United States. Yet, they were installed directly in the vessel without any workshop tests. However, at the dock trials they turned over as sweetly as a tuned-up motor of a racing automobile, and on the maiden runs from Philadelphia to New York and from New York to Boston put-up splendid performances, equal to the operation of the engines of any one of the eighty-six motorships with the same design of engines built in Europe during the last ten years. This is a credit to American engineering and shipbuilding.

"WILLIAM PENN" VERSUS TURBINE ELECTRIC SHIP

REFERRING to the comparisons of the operating costs of the various geared-turbine, turbo-electric and reciprocating steam-driven ships with the motorship "William Penn," we have before us a record of the performance of the turbo-electric freighter "Archer" taken on a twenty-two days' voyage, during which she covered a distance of 4,760 nautical-miles on a total of 4,829.9 barrels of oil, which works out at 104 barrels of oil per 100 miles compared with 34.09 barrels for the "William Penn." The oil used was 18 deg. Be. The "Archer's" speed averaged 8.9 knots, her engine averaging 2,516 shaft h.p. at 93 r.p.m., the vessel having an average loaded displacement of 14,153 tons and a mean draft of 25' 8½". The fuel-consumption figured out at 1.19 pounds per shaft h.p. hour compared with 0.30 pound for the "William Penn." However, we would point out that the bottom of the "Archer" was in a dirty condition during most of the voyage, which retarded her speed.

BRITISH STEAMSHIP OWNER AND MOTORSHIPS

BEFORE the stockholders of the Sutherland Steamship Co., Ltd. (Isles Steam Shipping Co., Ltd.), Newcastle, England, Sir Arthur M. Sutherland, Bart., said that "he thought there was a great future for the motorship. The motorship, instead of burning about forty tons of coal per day, would only burn about seven or eight tons of oil. There was considerably reduced costs in running in motorships by their requiring fewer men than did steamers and the motorships carried the oil for fuel purposes in the ship's tanks, and thus left a larger space for cargo. His idea," continued Sir Arthur, "was that when favourable opportunity offered they would probably go in for motorships for their companies. But the time was not opportune yet, but when that time came the shareholders would be told. At present the cost of building new tonnage is too high."



Launching of the first Kosmos Line Deutsche B. & W. Diesel-engined motorship at the Deutsche Werft, Hamburg. She is referred to elsewhere in this issue

"Dinteldyk" A 19,300 Tons Displacement Motorship

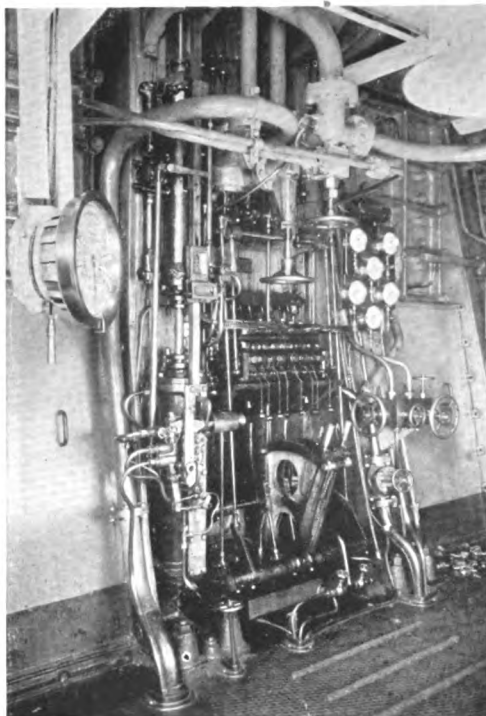
THE number of vessels of about 20,000 tons loaded displacement and 13 knots speed are steadily increasing abroad, eight vessels of this size now being in actual service, while four more are under construction, making twelve in all. The "Dinteldyk," the first big motorship to be owned by the Holland-America Line, of Rotterdam, reached San Francisco May 2 on her maiden voyage, making the 8,164 nautical miles voyage from London through the Panama Canal in 25 days actual cruising time on a total consumption of 534½ tons of fuel-oil. Later she called at Puget Sound ports and then returned to Europe. She will be regularly used between Rotterdam, London and other European ports and the Pacific Coast of the United States.

Her refrigeration facilities for carrying fruit are of particular interest in California, where the farmers' co-operative marketing associations that control practically every important variety of fresh fruit sold have begun to turn in the last two years toward water-transportation as a means of keeping railroad freight-rates down and also of providing an additional outlet toward the world's markets for a constantly increasing output of oranges, lemons, grapefruit, peaches, pears, prunes, apricots, raisins, figs, melons, grapes, etc.

Although several deliveries of citrus-fruits have been made by water to the Atlantic Coast of the United States, lack of refrigeration facilities has been a serious handicap, as the transcontinental railroads provide refrigerator-space for all shipments. With speedy vessels like the "Dinteldyk" and "Lochkatrine" available European ports will be brought in almost as close touch, in point of time, as the American Atlantic seaboard now is with California.

The "Dinteldyk" has 94,140 cubic feet of cooled space, the refrigerating equipment being two electrically driven Hall machines. On the maiden voyage cheese and herring, filling about 10,000 cubic feet, were carried outbound,

New Dutch Express-Freighter Calls at San Francisco, Carries 764,459 Cubic Feet Cargo Underdeck at 12¾ Knots on 18 Tons of Fuel—London to the West U. S. Coast on 583 Tons of Oil in 25 Days



Control platform on one of the engines of the "Dinteldyk"

while on the return trip to London and Rotterdam a large amount of frozen and canned salmon was booked from Puget Sound ports. Besides the cheese and herring, the outbound cargo included about 10,000 tons of glass, sand, iron, steel-billets, pig-iron, crockery, coffee and other general merchandise.

We have purposely omitted the deadweight-

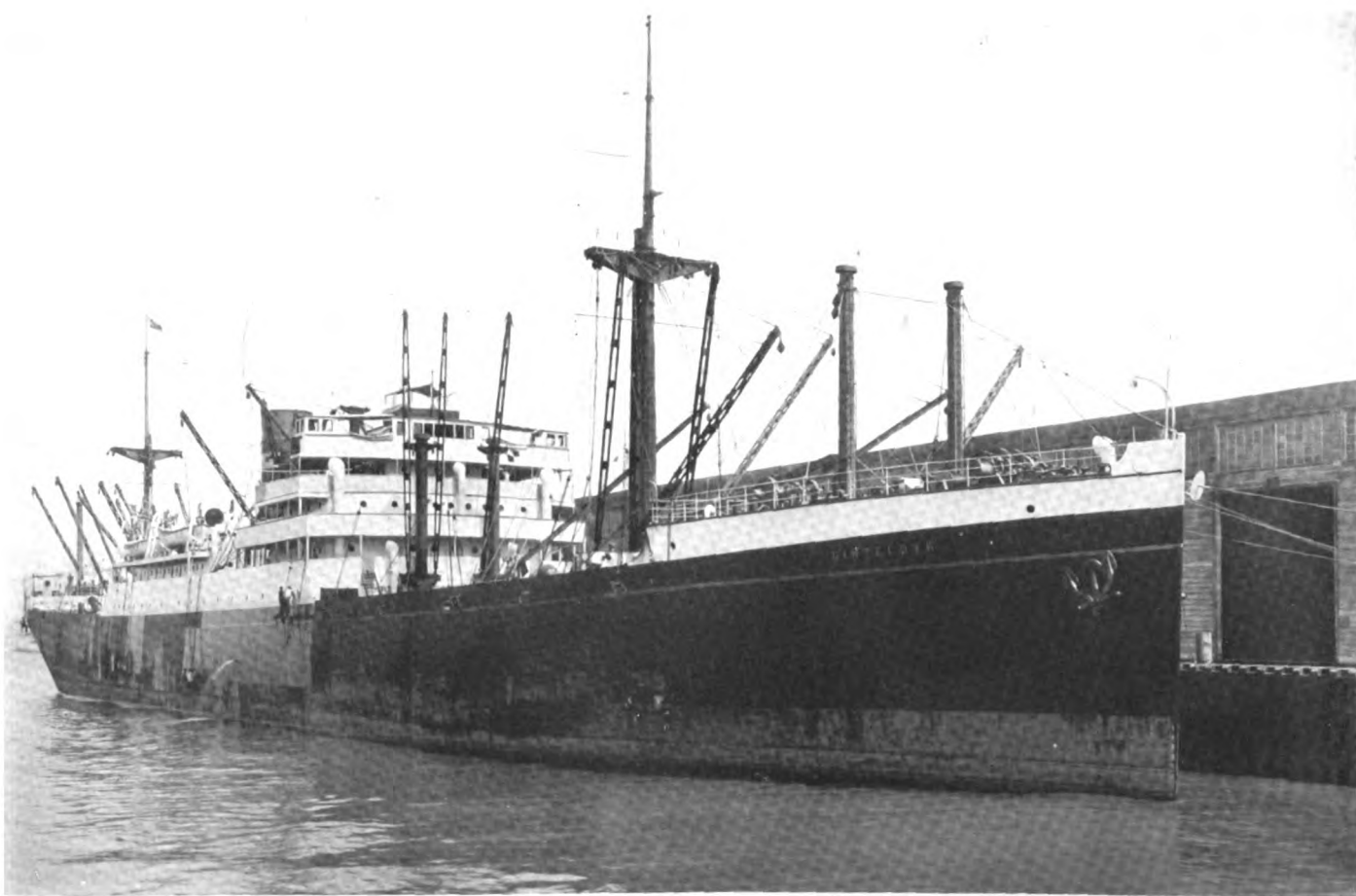
capacity of this vessel because of it being so misleading, and it is better for shipowners to compare her performance with those of steamships of the same cubic-capacity, on weight cargo capacity, and average speed. It will be noted that the underdeck cubic-capacity of the "Dinteldyk" is 764,459 cu. ft. and her net weight-cargo about 12,250 tons, exclusive of fuel and water. She has 94,140 cu. ft. of refrigerating space. She carries this quantity of cargo from 12¾ to 13 knots, without running the engines at full power, on a daily fuel consumption of 18 tons. Her twin-Diesel engines which are of about 3,150 I.H.P. have a total staff of 19 men, consisting of 8 engineers, 2 electricians, 9 oilers and cleaners.

When in port this big ship has a fuel-consumption of less than one ton per day. The total space required by the machinery is 82 ft. It will be noted that she carries 367 tons of fresh water. This is a greater quantity than is usually carried by motor-vessels, but it is necessary owing to the fact that twelve passengers have been provided for.

Her leading particulars are as follows:

Loaded Displacement	19,300 tons
Capacity of Holds	738,959 cu. ft.
Capacity of Deep Tank Cargo.....	25,500 cu. ft.
Total Capacity	764,459 cu. ft.
Refrigerated Space	94,140 cu. ft.
Bunker Capacity (oil)	1,241 tons
Fresh Water Capacity	367 tons
Cruising Radius	65 days or 20,000 n. miles
Length O. A.	502'0"
Length B. P.	485'0"
Breadth M. D.	62'0"
Depth M. D.	39'6"
Draught (Loaded)	29'6"
Shaft Horse-power	4,850 to 5,000
Indicated Horse-power	6,200 to 6,400
Engine-speed	115 to 125 R. P. M.
Ship's Loaded Speed (Main-tained)	12.75 knots
Trial Speed	13 knots
Daily Fuel-Consumption ...	18 tons
Port Fuel-Consumption ...	1 ton per day
Propeller	15 ft. dia. by 12½ pitch
Total Machinery Staff	19 men
Type of Engines, Burmeister & Wain 4-cycle Diesel	

(Continued on page 454 of this issue)



The Holland-America Line's new Diesel motorship "Dinteldyk" at San Francisco

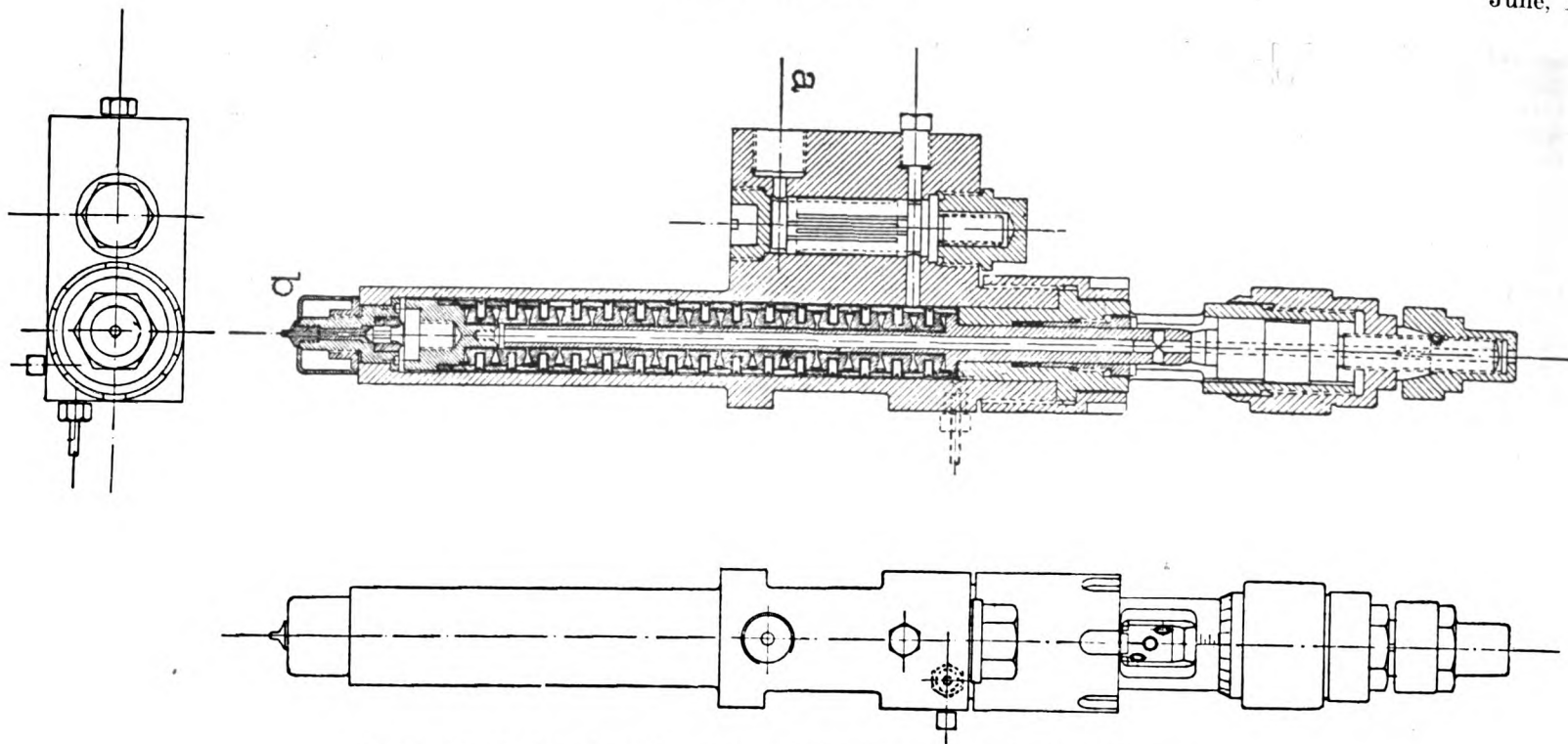


Fig. 1.—The fuel-injection valve of the new Hesselman airless-injection oil engine

New Airless-Injection System for Oil Engines

OF all the problems encountered in the design of high-pressure oil-engines the most difficult and at the same time the most important one is the proper injection of the fuel into the cylinder. Dr. Rudolph Diesel endeavored to inject the oil directly by means of a fuel-pump, but he did not obtain satisfactory results with his "solid-injection." As we to-day easily can comprehend, he had to contend with too many unknown factors, many of which have not yet been completely solved.

Diesel resorted to the scheme of injecting the fuel by means of highly compressed air, and succeeded in gradually developing this principle to such a degree of perfection that it at the present time forms the standard practice with Diesel engines. While this system by the introduction of compression in two or more stages and effective cooling (as well as by special experience gained by time) has been developed to work fairly reliably, it cannot be denied that in spite of all the air-compressor with all its delicate parts still is liable to form an undesirable source of trouble. Its design requires considerable engineering skill, its manufacturing meets many difficulties in the shape of intricate castings and exceedingly accurate workmanship, and in daily operation the air-compressor as well as all the appliances for compressed air demand the greatest care and most conscientious vigilance. Particularly the lubrication requires continuous attention. Too little oil entails mechanical troubles, too much oil may cause explosions within the compressor or the piping. Explosions of oil gases may also occur if the compressed-air is turned on too suddenly or if the fuel-valve for one reason or another should stick in its packing thereby allowing hot gases from the cylinder to enter the air piping.

Attention has been called to the wear of the air pipes by water and dirt carried along by the compressed air and to the deterioration of air pipes and vessels by chemical and galvanic action whereby the resistance of the walls may be lessened to such a degree that the pipes will burst, exposed as they are to an exceedingly high pressure. Accidental interruption of the cooling may have similar consequences. It has further been found that the air blast from the fuel-injection valve exerts a very detri-

*Remarkable Results Obtained from
Highly Scientific Experiments Made
by Hesselman in Sweden*
By EDVIN LUNDGREN

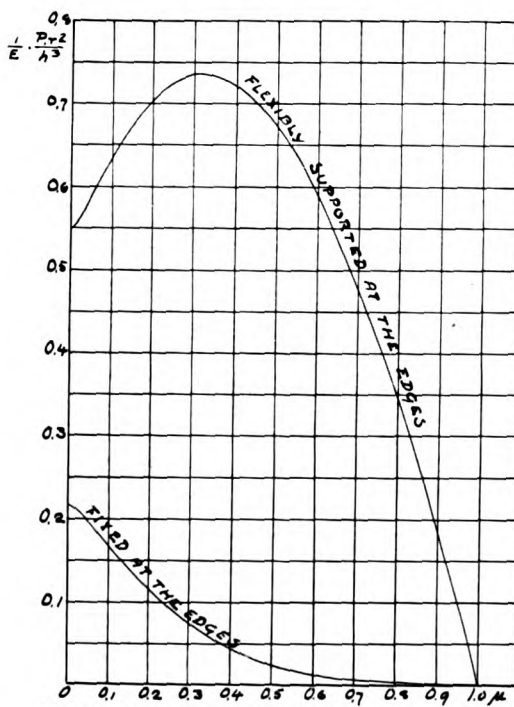
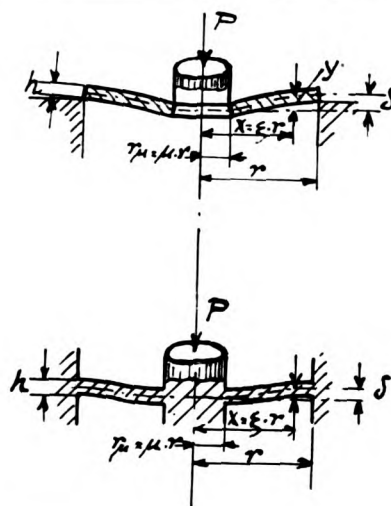


Fig. 2.—Deflection of steel discs under load

mental influence upon the central part of the piston causing it to crack and to deteriorate by oxidation.

All these reasons have led to very determined attempts to dispense with the air-compressor and the occasionally dangerous compressed-air injection. Of all those who have devoted their energy to the endeavor to develop "solid-injection" the most known and the most successful pioneer has been Vickers Ltd. As the Vickers system has been described extensively in "Motorship" (see November, 1919 and subsequent issues), the details of its construction need not be discussed here further. Many other similar designs and ideas for mechanical injection have advanced during the last few years such as Crossley's, Doxford's, Price, Banner, Wygodsky, Atlas-Imperial, Enterprise, etc., but naturally no existing system offers a final solution of the problem as there is always room for progress.

K. J. E. Hesselman of Stockholm, Sweden, who is known as the successful designer of the original Polar-Diesel engine has tackled the problem of airless-injection in the most scientific and thorough manner by investigating one factor after the other and by determining the influence of each one by theoretical calculations and reasoning as well as by carefully conducted experiments and tests. The results he has obtained in this manner are remarkable and a detailed description of some of the important parts will therefore deserve general attention.

Of paramount interest is the construction of the fuel-valve (fig. 1). The fuel enters the valve at A and is first forced through a high-pressure filter of a special patented construction which will be described later. The valve body is made of forged steel and has a fairly simple form. Its narrow shape allows the placing of the suction and exhaust valves in the head of a regular four-cycle engine at a close distance from each other. The fuel-valve is held in its place by a forked clamp (not shown) which is tightened by a single nut. To remove the valve, requires besides the disconnection of the fuel-supply pipe only a few turns on the tightening nut whereupon the clamp can be shifted sideways and the fuel-valve may be pulled out without any trouble.

Each time the fuel-pump delivers an accurately determined amount of fuel to the valve, the pressure within the valve rises to such an extent that the pressure of the spring (about 4,000 lbs per sq. inch) is overcome, and the fuel is squirted into the cylinder through the nozzle and burner B which is provided with a limited number of fine holes arranged in a definite manner suited to the form of the combustion space.

[The Baltimore Wygodsky airless-injection valve operates on a similar pressure principle.—EDITOR.]

The neatest feature of the fuel-valve is the spring which in spite of the high-pressure exerted is of exceedingly small dimensions. The fundamental idea for the spring was to use the deflection of circular steel disks supported, not fixed at the edges. A mathematical investigation of the problem, confirmed by exact experiments, revealed the fact that this deflection attained a maximum when the disk was provided with a hole of a certain size. Figure 2 shows the results of this investigation graphically for the two alternatives that the outer and the inner edges are flexible or fixed, the load in both cases being applied at the inner edge. If the load is uniformly distributed over the whole disk, the deflection

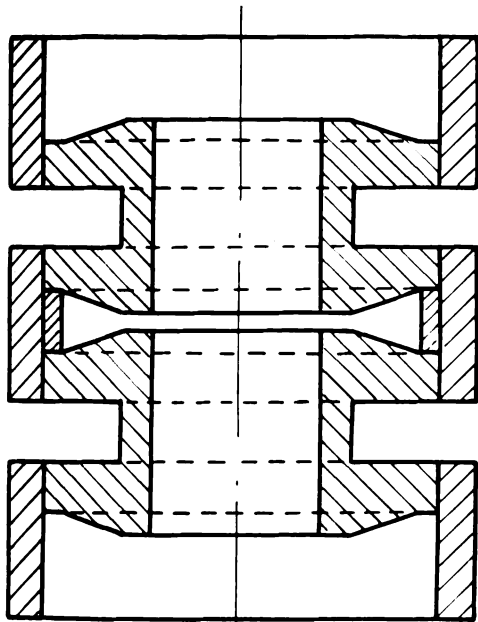


Fig. 3.—Spring elements

is varying with the diameter of the whole in a quite similar manner. In reality the load is a combination of the two cases.

The most practical form of the spring element finally adopted is shown in figure 3. Two steel disks are united by an inner circular web to a double disk. The spring is built up by a number of these spring elements, connected to each other by means of shrink rings and separated from each other by annular distance pieces.

The tension of the spring is adjusted by means of a nut on top of the valve which forces the spring spindle downwards. This spring spindle passes through a packing of suitable material lead or the like which prevents any leakage. It is to be observed that this spring, spindle, once adjusted, stays perfectly stationary and that it therefore does not meet the slightest difficulty to keep the packing tight.

Like the spring all the other details have been designed with due regard to manufacturing methods and particular attention has been paid to the choice of proper material. The valve itself, for instance as well as its seat are made of steel of high quality and hardened, so as to sustain the high unit pressures without any wear or deformation.

The main advantages of the new valve and particularly on account of the unique form of the spring consist of the following features:

(1.) The motion of the fuel valve meets no frictional resistance whatever. Consequently the lift of the valve is determined solely by the pressure of the fuel-pump, or rather by the amount of oil delivered by the pump to the valve. As this amount must be proportionate to the load, also the lift of the valve must correspond to the same. To show this relation between load and valve lift, some very interesting series of experiments were made.

To this end a rod was attached to the valve proper. This rod which passed through the hollow spindle (made hollow for this purpose) actuated a diminutive mirror which reflected the light ray coming through a small aperture from a stationary source of light, a small acetylene lamp, and deflected by a prism so that it always fell upon the mirror. At the same time the mirror received an oscillating motion which was directly proportionate to the travel of the engine piston but at 90° to it on the crank circle. Consequently the light ray reflected from the mirror shows the lift of the valve in relation to the piston stroke. This relative motion was caught on a photographic plate or still simpler and faster drawn piece by piece on a paper placed upon a transparent plate where the lines described by the light ray were visible.

Figure 4 shows the motion of the fuel-valve at different loads. The injection begins always at the same time, but the lift and the opening time of the valve are of course increasing with the load.

The optical indicator described was made by J. Carpentier, Paris and makes it possible to examine what influence the stroke and the speed of the fuel-pump and its controlling mechanism exert upon the action of the fuel-valve. Thus in connection with some other observations certain valuable conclusions were arrived at with respect to the most favorable shape of the cams actuating the pump and the fuel distributing valves.

(2.) The absence of any mechanical means to actuate the fuel-valve implies in itself a considerable simplification in comparison to ordinary Diesel engines as well as to the existing airless injection methods. This advantage is of course particularly pronounced in reversible engines and is naturally the more important, the more cylinders the engine has.

(3.) The valve can be placed in any position, horizontal, vertical or inclined, without any regard to lay shaft or any other valve gear.

(4.) The construction of the valve lends itself to a high degree to standardized manufacturing. Not only are the different details fairly easily produced and finished but the same valve may be used for a number of different sizes. It may, of course, be necessary to use valve bodies of different length and to vary the number of spring elements employed. The convenience and ease in manufacturing in connection with the marked simplicity will certainly appeal to American views.

Intimately connected to the problem of injecting the fuel is the construction of the fuel-pump. This pump shows also many entirely novel and original features. It may be mentioned that the pump as well as the fuel-valve are covered by a number of patents which have been granted in 18 countries.

The main characteristic of the pump is that it has only one plunger, even if used on multiple cylinder engines. Consequently the pump has to run with at least such a speed that its number of pressure strokes corresponds to the number of power strokes of the engine. Thus the pump of a four-cylinder four-cycle engine has to run with twice the engine speed i.e. making twice as many revolutions as the main shaft.

The amount of oil delivered each stroke is just as in a Diesel engine controlled by open-

ing a common suction valve which stands under the influence of the governor and simultaneously is adjustable by hand. The fuel is then distributed to the different cylinders by means of mechanically operated distributing-valves.

A more detailed description of the fuel-pump together with an explanatory drawing, will be given later when also the full report of a thorough test of a 2-cylinder 65 H.P. engine will be published. It may, however, now be stated that the fuel-consumption of this engine at rated load amounted to 0.383 lb. (175 grams) per brake horsepower hour. The engine has a cylinder diameter of 250 mm (10") and a piston stroke of 370 mm (14½") and runs at a speed of 300 r.p.m. Even at 30% overload, i.e. when the engine was developing 85 H.P., the exhaust-gases were absolutely invisible. Considering the size of the engine and the fact that it was the first experimental engine, a rebuilt ordinary Diesel engine, the results must be called very good and very promising indeed.

The main advantage of the new Hesselman system is that these results were obtained with

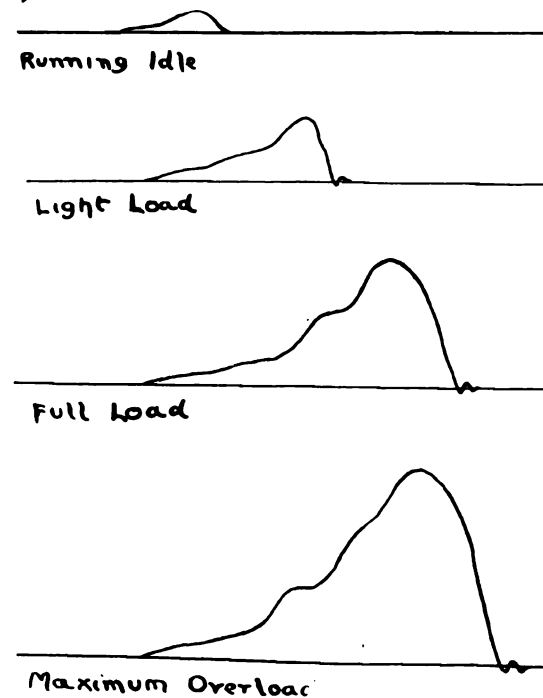


Fig. 4.—Hesselman fuel-valve lift at different loads

comparatively simple mechanical means. Simplicity of the construction and, perhaps of still greater value, simplicity and convenience of the attendance required by the new engine in comparison with the ordinary Diesel engine are the outstanding distinguishing features of this new air-less injection system.

LECTURE ON DIESEL ENGINES

Under the auspices of the Corporation of Glasgow, a lecture on Diesel-engines was given by Professor Mallamy who traced the development of the marine oil-engine of this type. As a matter of historical interest he referred to the Diesel-engine built by Mirrlees, Watson & Co., Glasgow, in 1898, which was tested by Professor Watkinson at the Technical College.

REVIEWS

Eliminating Vibrations. Booklet issued by the Vibration Specialty Co., Philadelphia, Pa. Every engineer is aware of the waste of power, the uneven wear, increased up-keep and even of the danger caused by vibrations if set-up in an oil-engine in operation. That static or dynamic unbalance can be accurately and scientifically located and eliminated may or may not be known to him. If he will read this little book issued by the Vibration Specialty Co., whose sole work is elimination of vibrations the importance in marine work of this work will be apparent.

Diesel Development in the British Navy

OUR first experiment afloat was the fitting of electric generating engines of the Hornsby-Ackroyd type in three battleships as peace installations (nearly twenty years ago). These were virtually additional engines to meet abnormal load requirements and were placed on the upper deck, not under protection. They were fairly satisfactory only when using clean fuel oils, such as shale or gas oil, and attempts to use the same fuel oil as that supplied for use under boilers were successful only for a very limited period.

However, the obvious advantage of the use of oil engines in being able to provide electric light when steam was down, for executing repairs, or in the event of the steam service being put out of use during action, was demonstrated, and caused them to be further considered for electric generating purposes.

These engines had each three cylinders, 15 inches in diameter by 15 inches stroke, and ran at 400 revolutions per minute. The fuel-oil consumption was about 0.9 lb. per brake horse-power per hour, and the lubricating-oil consumption about 4 per cent. of the fuel-oil consumption.

In 1905, when the designs for the "Dreadnought" were being prepared, it was decided that this ship should be provided with two Diesel dynamos, each of 100 kilowatts capacity, and that she should carry two 50-foot pin-naces fitted with Diesel engines of 120-brake horse-power running at 400 revolutions per minute. At that time there was no experience in this country with any Diesel engine which had been run at a speed greater than 200 revolutions per minute.

One of these engines was later replaced by a steam engine. This is not the only case within my knowledge where the failure of a Diesel engine could be fairly attributed to want of stiffness in the foundation. Designs of foundation structures for Diesels have often been based on those for steam-engine practice, and sufficient consideration has not in many cases been given to the very different nature of the loads and of the fluctuation of

Extracts from Enlightening Paper Read by Engineer-Vice-Admiral Sir Geo. G. Goodwin, K.C.B., L.L.D., Engineer-in-Chief of the British Navy, Before the Institute of Engineers and Shipbuilders in Scotland

those loads from those of corresponding steam-engines of similar power. Even now I think the importance of this point is sometimes overlooked, and the failure of Diesel engines is attributed to the engines themselves, when the foundations and not the engines are at fault.

After the "Dreadnought" came the battle cruisers "Indomitable," "Inflexible," and "Invincible," and battleships of the "Bellerophon" class, each ship being fitted with two 100-kilowatt Diesel engines.

In the early part of 1911, it was arranged to fit a combination of oil engines and turbines in a torpedo-boat destroyer. Two sets of two-cycle Diesel engines, each with four cylinders, were to be fitted immediately forward of the turbine engine-room, and geared to the corresponding turbine shafts, helical gearing being used. The maximum number of revolutions of the Diesel engine was to be 325, to be reduced by gearing to 260 revolutions, corresponding to a speed of 15 knots. The power of each engine was to be 850, the total 1,700 brake horse-power. The Diesel engines were to be used for cruising speeds. Unfortunately difficulties were experienced during the manufacture, although the very best help was obtained by the firm, and the engines were not fitted in the vessel.

The Diesel electric-generating engines previously referred to were not so reliable on service as could be desired. During the period which had elapsed experience was being gained, and reports were on the whole becoming favorable. It was generally admitted that the Diesel engine was undoubtedly an acquisition in a ship; its economy was beyond question.

It is of interest to note that as the *personnel* became better acquainted with Diesel generating engines, the desire for them was in some cases so great that they were preferred to the reciprocating steam-generating engines; the economy was very marked, one ship giving in comparison 35 tons of oil for the Diesel engine against 350 tons of coal for a reciprocating steam engine, doing the same work. As a result of the more favourable reports, it was decided to fit one oil-driven dynamo of 150 kilowatts capacity to the ships of the 1911 programme, and generally since that time two Diesel generators have been fitted in capital ships.

To-day, although it cannot be stated that the oil engines are as reliable as the steam turbo plants, the results are on the whole satisfactory.

For moderate powers and comparatively low speed of revolution, such as are required for many merchant ships, where head-room and space are not so limited as in warships, there has been considerable development, and the large number of Diesel-engined ships now in use and building is an indication of the increased reliability expected and being obtained.

The manufacture of Diesel engines demands in many respects a higher standard of workmanship than the reciprocating steam-engine, and what is even more important, a better education of the *personnel*. In some details this high standard of workmanship is not required, and if maintained throughout it adds to the cost without adequate return, with possibly some disadvantages, and it is in my opinion questionable whether, if a mixed standard can be permitted, it would not be advantageous from the competitive point of view. In our own Admiralty work, where we join to the full in requiring a very high standard for the vital parts, we are rather encouraging a lower standard for the less important parts. We believe that we shall get cheaper engines without detracting in the least from their efficiency, reliability, or durability.

(To be continued in our July issue)

Actual Running Costs of Motorships

ALMOST two - and - a - half years have passed by since I on behalf of my owners, Rederi A/B Transatlantic of Gothenburg, Sweden, came across and fell in love with Doxford's experimental engine of the opposed-piston and direct high pressure-fuel injection type. * * * However, I hoped that my Director, Gunnar Carlsson, would not allow me to "boost" the internal-combustion engine—because that is what one actually does when reading a paper on actual running costs of motorships; but Mr. Carlsson was too broadminded to take any objection. * * * When my company adopted motorships they selected the Burmeister and Wain four-stroke type of engine. The ships were built and engined by Götaverken, Gothenburg, and were this firm's first experience of the construction of motorships as well as ours. The vessels were known as the "Bullaren" type and have rendered my Company excellent service. Unfortunately, one of them, the "Elmaren," ran ashore in the Chagos Archipelago and was a total loss. They are twin-screw ships with total 4,000 i.h.p., and they are among the finest and fastest cargo liners in service. Other motorships are under delivery or construction, among the latter being two different

*Valuable Information Released by a Big Swedish Shipowning Company Who Have Ordered Motorships with Three Designs of Diesel Engines**

By TADGE MADSEN

Superintendent-Engineer, Transatlantic Steamship Co. Göteborg

types of single-screw ships—one Burmeister and Wain long-stroke type, another of the Stockholm Atlas - Diesel type. They are smaller than the "Bullaren"—about 5,000 d.w.—and built by Götaverken except for the one motor.

The company also contracted for some motorships in England with the firm William Doxford and Son, Sunderland, and is thereby now the owner of the biggest motor single-screw job I so far know of. This ship you know as the m.s. "Yngaren," and I am certain that most of you have followed her on her long maiden voyage of some 28,000 miles. The sister ship, m.s. "Eknaren," will soon be ready for sea. This type has, as you know, one 3,000 i.h.p. motor, and it gives you a good shaft power owing to the absence of compressed air during continuous run, etc.

I will now try to give you some details of

the Bullaren type, "Yngaren" and the steamer "Auten," which has a sister hull to that of the "Yngaren." But before doing this I will look on the subject of costs from various points—questions like *Building Cost, Engineers, Fuel Oil, The Motor, Repairs, Consumption, etc.*

Building Cost.—It is a very expensive, if not even an extravagant matter, to build a first-class motorship nowadays, though prices of material and labor have fallen considerably since the great boom in shipping. *But it is worse to build a steamship:* that is the only consolation.

If a new ship is needed to-day I do not think you can get a first-class motorship, 10,000 d.w., under £275,000—not that the corresponding steamer can be built much more cheaply, but there are so many good second-hand steamers idle at present and obtainable at low prices, that the bigger money outlay for the motorship in comparison with the steamer has to be considered. A good motorship can also be obtained by converting an old good hull, but unless one is very careful in all details the converted vessel may, in the end, be almost as expensive as an altogether new motorship.

* * *

The Engineers.—This question is of greatest importance; many of us do know, and that is about all. This is not the clipper-ship era and the days before that when a captain was

* Paper read before the Northeast Coast Institution of Engineers and Shipbuilders, April 21, 1922.

almost mightier than the owner—when he chased along the high seas, in the strongest gales, with every stitch of canvas set, changing clothes once a day, but seldom sleeping in the berth; always on watch, always ready. No; as one captain among my friends remarked, "It is those damned engineers, who have taken the poetry out of seafaring life." In a way he was right although it would have been fairer to blame the engines instead of the engineers; so it is everywhere where modern developments have entered. The early steamship was just as much a sailing ship, but even in modern steamers I am not certain that the importance of good engineers is fully recognized. There are shipowners who hardly think of engineers except when they see a heavy repair bill.

Do not misunderstand me: I know well enough that the seas are still full of dangers. The captain and master of the ship did not die with the sails, but down below is the place where money is heavily consumed, where terrible waste or praiseworthy saving takes place. I do not think all engineers are admirable, but many are and those must be recognized, and must be appreciated in such a way that they feel it. Thus, the first condition is to get the ambitious engineer to work. What otherwise the benefit of trying to reduce consumption articles when the predecessor used just as much, or why work on board on things one mostly surely can get made ashore? Or, of what profit is it to a chief-engineer to be in charge and responsible for a big motor engine, when the engineer next under him earns just as much by overtime and has no responsibility, excepting that while on watch?

One man must have the responsibility, and to-day the engineer in charge sleeps only with one eye at a time, if he is the right man. He must know what is wrong before anything happens, and take precautions to prevent it.

* * *

Let the young engineers be associated in unions, etc., with pay according to seniority and horsepower, but let there be one position, the chief engineer's, the attainment of which is worth working for. When the engineer has reached such a position, he will know and feel that he is appreciated and compensated, instead of belonging to a certain column and a certain line in a wage tariff—knowing that there he is as long as he does not prove himself too bad. * * *

The engineers cannot, of course, do their savings by themselves; they must have their helpers. These men we call in Sweden motormen, and in addition to them we generally supply one electrician, one turner and one blacksmith. In the case of the "Yngaren" we could run with one motorman and one engineer on each watch; in that of the "Bullaren," with two motormen and one engineer on each watch; but here it is for the shipowner and his officials to decide between what is minimum necessity, and what it is advisable to have in order to maintain everything in first-class condition. * * *

Every shipowner will soon find what the number of men ought to be. If they should carry one or two too many it does not matter much: a good chief engineer has always plenty, and, for the engine, beneficial work to do. Thus I hope you admit that even the quality and number of these men does influence the actual running costs of motor ships. * * *

The Fuel Oil.—The price of fuel-oil is, of course, the most important matter in the running cost of motorships, provided that the motor you have is a good one and the men on board in charge reliable. * * *

The biggest error in my mind at present is the talk of boiler fuel-oil and Diesel oil, and the difference in price, 30s. per ton to my latest knowledge. The various qualities of oil have

thus come to be divided into two groups: boiler-fuel oil and Diesel-engine oil. One day you buy a Diesel oil and you get (this experience is outside of England) an oil full of sulphur, asphalt, etc. Another day you buy what they call "boiler-fuel oil" and you get the finest so-called Diesel-oil but pay the lower price. Will the oil companies now make another kind of oil for the Doxford motor? Will they produce a boiler-Diesel fuel oil mixture for Scott's Still engine? What will be the price of these new fuels?

Here it ought to be as it is with everything else in this world, payment according to quality, the quality to be proved by analysis delivered on board together with the oil. This analysis could, later on, be delivered at home with samples, and if necessary, correctness verified. If anything is wrong the supplier will have to compensate. Why should the owner suffer from higher repair bills, and the engineers have a hard time on long tropical voyages because the suppliers have sold Diesel oil and delivered something else? Or did this oil perhaps become a Diesel oil when the engineers started to burn it in the Diesel engine?

Builders and owners of motorships and fuel-oil companies must work together in forming sound and safe business conditions for the sale and delivery of fuel-oils to all kinds of motorships. Let us speak of light, medium light, heavy and extra heavy fuel-oils if it is necessary; but most decidedly payment must be according to quality. This can, where competition is excluded, be based on specific gravity, asphalt and hydrogen content. The less asphalt, the more hydrogen, the finer the oil; the more asphalt, the less hydrogen, the cheaper the oil. Sulphur is often regarded as bad, but, inside the engine, it does no harm in other respects than that a highly sulphuric oil is generally highly asphaltic. Any good way of looking at these difficulties, leading forward to good and reliable conditions in the fuel-oil market, will be beneficial.

Certainly, conditions are not always as bad, and I am not arguing the above points from any particular experience of my company, but, from what I have learnt from having been in touch with many motorships and from colleagues of mine. * * *

When you can buy and pay for the oil according to quality, this item in the running cost will be simplified. You know your engine and you know what oil it can be worked with. One also knows that with the cheaper oil extra outlays follow—valve troubles, heating of the oil in the settling tanks and, in certain waters, also heating of the oil in the double bottom. The cheaper the oil one decides to use the greater the care one must exercise to ensure good and efficient settling of the oil—not only that the cheaper oil generally carries proportionately more water, but, as a rule, it holds a good deal of foreign matter. An interesting example of the bad effects of the latter, through no fault of any oil company, was one motorship which took oil in a double-bottom tank which had previously been used for water ballast only and was cement washed. When fuel was taken from this tank the fuel valves became burnt repeatedly. This was due to cement particles passing through the settling system with the oil to the valves and spoiling the seats. The vessels of our Bullaren type have made several voyages with no stops on any of the motors, and our voyages are almost as long as you can get them on this hemisphere; at other times, there has been repeated stops for changing exhaust valves, etc. For this type so-called Diesel oil is always bought.

The "Yngaren" type is regarded as more tolerant, especially for heavy oils—so-called boiler fuel oil. We have not so far burnt anything heavier than 0.91 Anglo-American; also

0.89 Anglo-American, 0.87 Gallizian oil and Anglo-Persian 0.895. The next engine has run on 0.945 Mexican oil. There is, however, some difference in burning it out at sea, but no doubt it will pay to burn such an oil, if proper arrangements are made for the heating up and settling. This certainly often is sinned against, and much nasty unnecessary sea work could be avoided. Good settling is a very important matter, and when well done, it certainly saves a lot of trouble and cost, making it possible to burn a dirty water-mixed oil if nothing else is to be had.

Another thing: the oil trust are about the slowest people on internal-combustion, when they ought to be in the first line to stop their own waste of so-called boiler fuel-oil, and thus on their own account try to reduce the actual cost of the fuel; but perhaps it is cheaper for them with boilers, considering the premium per ton, even taking into consideration the lost cargo-carrying capacity. The oil trust should try to come up into the first line; they have power to rule over countries, and they have oil and money to take on the little risks of being in the front line doing their part to bring improved types forward and in bringing up good engineers without delay.

The Motor.—It is hardly possible to read a Paper of this kind without saying something about the motor. When a shipowner to-day has advanced so far that he has decided to build a motorship, there are, if he does not need particularly high power, already many good types of motors to choose from.

I heard in England that one set of motor engineers, one of steam engineers, and one professor are all needed to run the Still engine. I have paid a few visits to Scotts and admired their work, with which I wish them success. They certainly deserve it. If they put a hardheaded responsible-feeling Scotch chief engineer in charge, the professor will soon pack his bag and the staff otherwise be considerably reduced.

If I had worried much over what I heard in connection with Rederi A/B Transatlantic buying Doxford's very first motorship—built by a firm with no experience of marine motors at all (some people worried over this fact)—I would have been fairly white-haired by now; and had the bad predictions proved true, I would certainly not have had the pleasure of standing here to-day. * * *

(To be continued in our July issue)

SWEDISH MERCHANT SHIPS' SUBSIDIES

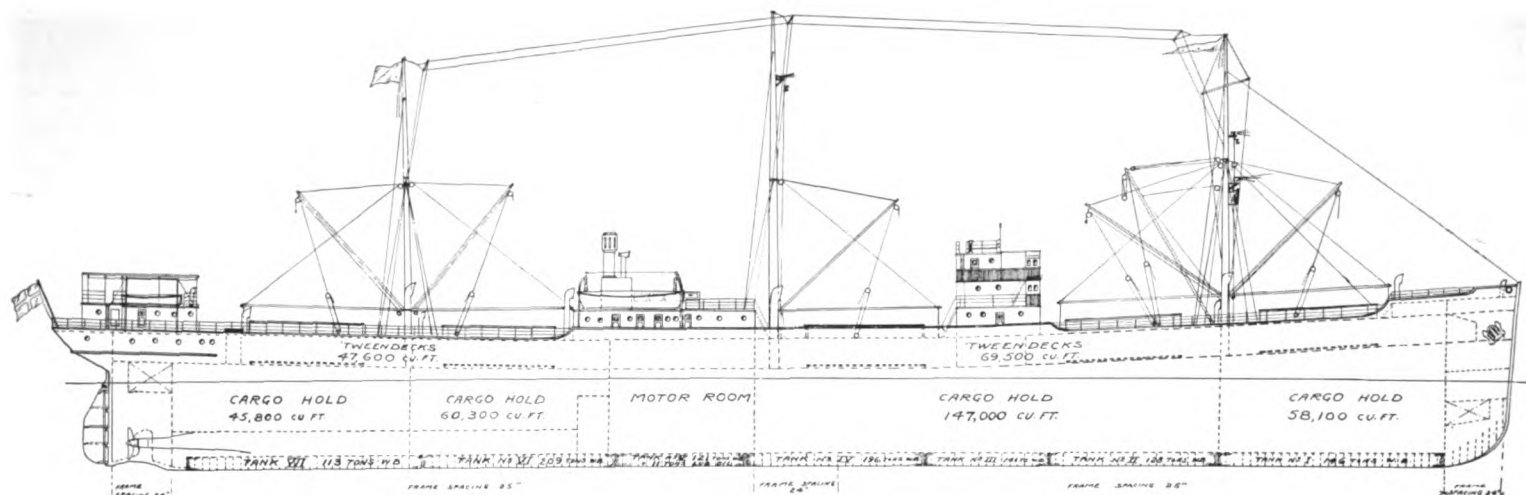
It is proposed to grant five million kroner in the form of subsidies to encourage the construction of merchant-vessels in the Swedish shipyards of Swedish materials. It is also proposed to build the following ships—

Type of ship	No. of Vessels	Tonnage per ship
Motorships	3	10,100
Motorships	3	6,700
Steamships	12	3,500
Steamships	12	3,000
Steamships	12	2,500
Steamships	12	1,000

The subsidy is to be at the rate of 100 kroner per ton and will be sufficient to construct 54 vessels of 170,100 tons.

BURMEISTER & WAIN DIVIDENDS

Shipyards and machinery manufacturing concerns generally should be interested in learning of the profitable business which can be conducted even during a world-wide shipping depression by a well-equipped plant devoting its attention to Diesel-engines and motorships. Such a plant is that of Burmeister & Wain, of Copenhagen, Denmark, which firm paid a dividend of 12 per cent out of last year's profits. The dividend for 1921 is the same as for the year 1920, when the profit was about 10,000,000 kroner.



Outboard profile of one of the two twin-screw 7050 tons deadweight motorships building for A. P. Möller

Three More Motorships Building for A. P. Möller

PROBABLY A. P. Möller of Copenhagen is best known to MOTORSHIP readers through his new single-screw motorship *Leise Maersk*, the story of whose round-the-world maiden-voyage will be described in our next issue. The success of this vessel has demonstrated to Mr. Möller that medium-size motorships can be operated to advantage just as well as the larger Diesel-driven craft which have operated on long voyages ever since the first East Asiatic Company and Asiatic Petroleum Company's motorships began their voyages. Mr. Möller long ago intimated that he would embark on a real motorship program if such craft of moderate dimensions could be profitably operated by him. The voyage of the *Leise Maersk* having answered the question in the affirmative, he has commenced the construction of one 5,125 tons D.W. and two 7,050 tons D.W. motorships at the Odense Steel Shipyard—all to have Burmeister & Wain engines—at Odense, Denmark, in which yard Mr. Möller is financially interested. It will be noted that this yard also turned out the *Leise Maersk*.

It is not at all unusual, in fact, it is quite common, for European ship-owners to be financially interested in shipyards and Diesel-engine works. It is general knowledge that the East Asiatic Co. are interested in the

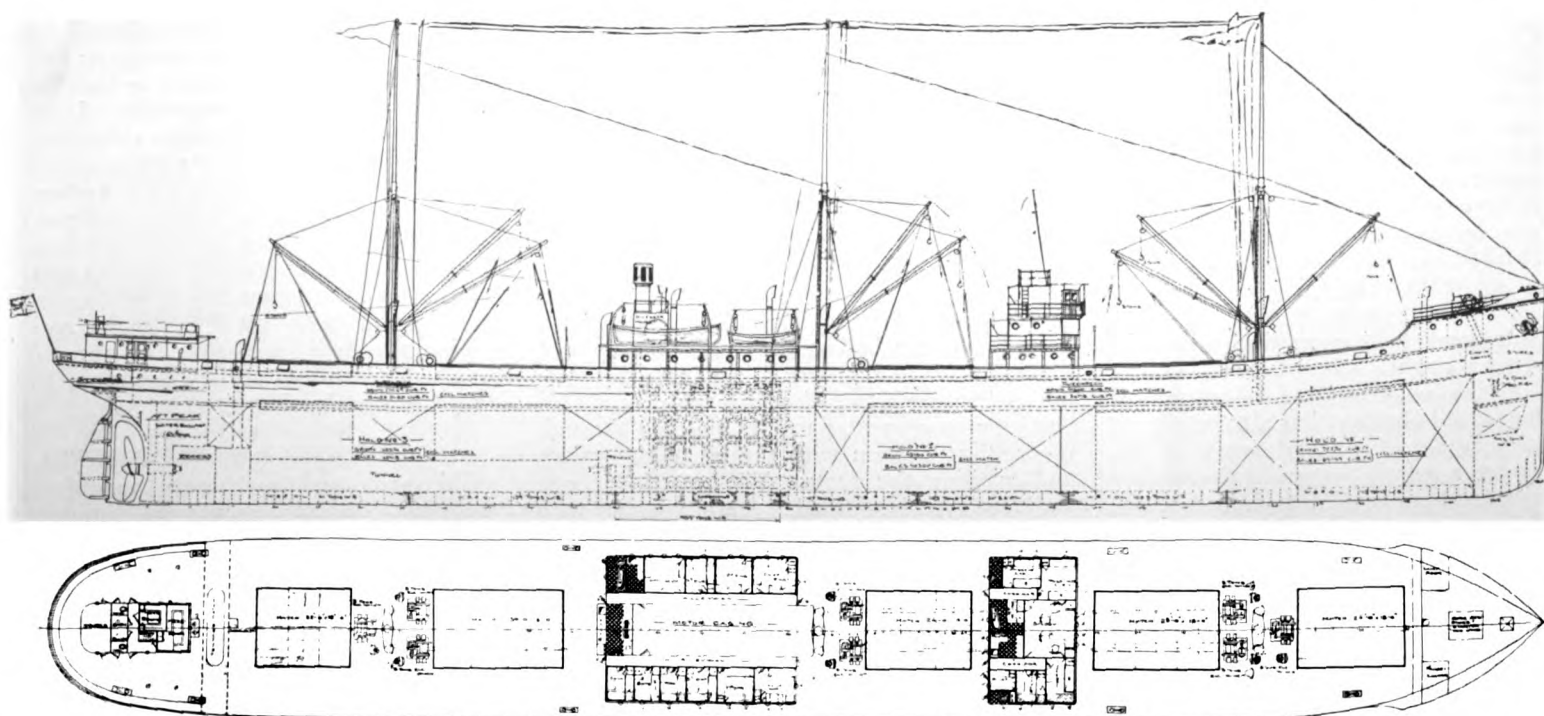
Owner of the "Leise Maersk" Adopts Extensive Motorship Program

Nakskov shipyard, Nakskov, Denmark, and that Fred Olsen, the well-known Norwegian ship-owner, has an interest in the Akers Mechanical Works, of Kristiania, and that Dan Brostrom, the Swedish ship-owner of Göteborg owns an interest in the Götaverken. It is to the advantage of ship-owners to be interested in shipbuilding and engineering works, both because of the lower cost of their vessels as well as in order to have at all times a plant which can economically handle repair-work and up-keep. We believe that American ship-owners would do well to be interested in such plants and venture to suggest that if more ship-operating companies were represented on the directorate of our shipyards and engineering-plants that America to-day would be producing more Diesel-engines and more motorships than we are. This is indicated by the Harriman interest in the Cramp & Merchant shipyards. For the ship-owner is right up against the costs of operation and if he is wide-awake he must know of the great savings which a motorship makes possible, which knowledge we feel would influence the shipyard to adopt standard motorship construction.

While the order for three Burmeister & Wain engined motorships was placed in Germany by Wilhelm Wilhelmsen of Kristiania, Norway, because of the advantage of exchange rates, the orders placed by Mr. Möller are because the motorship has shown up to such great advantage as compared to his steamships, as he, like Mr. Wilhelmsen, operates both types. None need be advised that the past year has been a hard one for ship-operators because of the general slump in freight-cargoes, and it has required just this slump to accentuate the advantages of the motorship. No steam-driven vessel could have made the voyage of the *Leise Maersk* and shown a balance on the right side of the books to-day.

The Odense Steel Shipyard is one of those started during the war days, but, unlike many of such yards, will continue in operation. Had American shipyards adopted standard motorships such as those shown in the accompanying plans perhaps many of them would to-day be producing motorships instead of being idle or closed.

A study of the accompanying design of the 5,125 tons D. W. vessel reveals that she will follow very closely the design of the "*Leise Maersk*," which was published on page 803 of October, 1921 issue, being simply about 30



General arrangement of the new single-screw 5,125 tons motorship building by the Odense Shipyard for A. P. Möller, owner of the "*Leise Maersk*"

ft. longer, but of the same breadth and depth and to be powered with a duplicate of the long-stroke Burmeister & Wain engine installed in that vessel. With her longer hull and easier lines she should therefore drive easier, be a better sea-boat and a more profitable craft, as in addition to these advantages over the shorter "Leise Maersk" she will carry about 685 tons or 20,016 cu. ft. (bale) more cargo at the same, if not better, speed and with identical horse-power. The principle dimensions of this new vessel now designated Yard No. 10 are:

Displacement	7150 tons
Length over all	345 ft. 0 in.
Length between perpendiculars	331 ft. 0 in.
Breadth	44 ft. 0 in.
Depth to main-deck	21 ft. 11 in.
Depth to shelter-deck	28 ft. 11 in.
Draft	22 ft. 0 in.
Displacement (light)	2,025 tons
Net-cargo capacity on long voyage	4,100 tons
Deadweight	5,125 tons
Water-ballast, Fore-peak	50.5 tons
Water-ballast, After-peak	65.0 tons
Fuel-oil, in double-bottom	709 tons
Fuel-oil, in fore-peak tank	20 tons
Fuel-oil, in engine room tanks	50 tons
Lubricating oil, in double-bottom	6 tons
Cubic-capacity of holds and 'tweendecks	253,473 cu. ft. (grain) 230,216 cu. ft. (bale)
Speed	10 knots
Horse power	1,500 I.H.P.

Two masts and eight 3-ton derricks served by Thirge electric-winches of like capacity handle the cargo through five hatches opening into the three holds of the ship. Two of

these hatches are 24 ft. x 18 ft., the others being 22 ft., 28 ft. and 30 ft. long by 18 ft. wide. These winches will be identical with those on the "Leise Maersk" which did such good work on her world-voyage.

Accommodations are laid out for two passenger staterooms in addition to fine quarters for the officers and crew. The general arrangement of the ship and the quarters is practically the same as those of the "Leise Maersk" and no comments are necessary. The anchor-windlass and steering-gear are electric-driven and in view of the large amount of electrical-apparatus to be installed we specially note that two electricians are provided for in the accommodation plan as the "Leise Maersk" carried no electricians, all electrical-work being attended to by the engineer-force. However, we presume that only one electrician will be carried.

Two large twin-screw motorships of 7,050 tons Deadweight now designated Yard Nos. 14 and 15 are also under construction at the Odense yard and through the enterprise of our Danish correspondent we are able to present these designs to our readers in advance of publication elsewhere, as we are also able to do in the case of the smaller ship. This larger craft is of the shelter-deck type of the following dimensions:

Length over all	395 ft. 0 in.
Length between perpendiculars	378 ft. 2 in.
Breadth molded	50 ft. 0 in.
Depth to main-deck	26 ft. 5 in.
Depth to shelter-deck	34 ft. 5 in.

Draft loaded	23 ft. 9 in.
Net-cargo capacity	5,900 tons
Corresponding deadweight	7,050 tons
Cubic-capacity of hold	428,300 cu. ft. (grain) 386,800 cu. ft. (bale)
Gross Tonnage	4,000 tons
Net Tonnage	2,300 tons
Fuel-oil capacity (double-bottom tanks)	1,053 tons
Lubricating-oil capacity	11 tons
Speed	10.5 knots
Horse-power, total	2,200 I. H. P.

Each of the propelling-engines is of the regular 1,100 I. H. P. Burmeister & Wain Diesel-type having six cylinders of 540 mm. (21.25 in.) bore and 730 mm. (28.74 in.) developing 800 Brake h.p. at 150 r.p.m. Three single-cylinder Burmeister & Wain Diesel-driven auxiliary-generators of 50 K.W. and a two-stage air-compressor for maneuvering-air are provided.

These two motorships are being constructed of American steel originally purchased for two motorships which were to be built by the Baltica yard for the Copenhagen and Gylfe Shipping Company, the material for which Mr. Möller has purchased. The 5,125 tons D.W. motorship will be assigned to the fleet of the Steamship Company of 1912 operated by Mr. Möller, who also owns and operates the Svendborg Shipping Co., to which fleet the "Leise Maersk" is assigned. We commend the accompanying designs and description of these vessels together with the record of the world-voyage of the "Leise Maersk" to the consideration of American ship-operators.

MOTORSHIPS IN THE SUEZ CANAL

In our last issue we gave some data showing the growth in the number of motorships passing through the Panama Canal. We are now enabled to give some figures regarding the increase of motorships passing through the Suez Canal. It is interesting to note that in the table of motorships the various nationalities passing through the canal during the last ten years, vessels carrying the American flag unfortunately are completely absent. So far as we are aware the recent voyage of the Shipping Board's motorship "William Penn" via the Suez Canal was the first time an American Diesel-engined vessel has ever passed through this water.

The following table shows the number of motorships using the canal during the ten years from 1912 to 1921, the number of passages they made, and their total tonnage. Small sailing ships with auxiliary motors are not included:

No. of ships.	Passages effected.	Net tonnage.
1912.....	3	27,000
1913.....	6	64,000
1914.....	11	97,000
1915.....	21	135,000
1916.....	25	182,000
1917.....	16	98,000
1918.....	9	81,000
1919.....	23	347,000
1920.....	40	437,000
1921.....	45	501,000

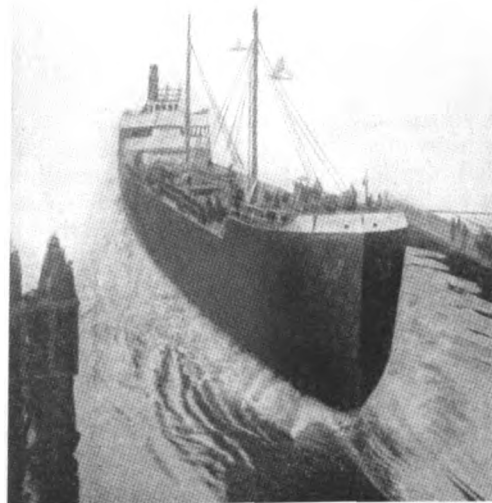
In 1912, when motor ships first made their appearance as users of the canal, the three units which passed through on seven occasions were under the Danish flag, and their 27,000 tons represented only a small fraction of the total transit, which, in that year, was over 20,000,000 tons. From that year and until 1916 the number steadily increased. In 1917 and 1918, that is to say, during the most critical period of the German submarine campaign, when motorships were used on the Atlantic, there was a decline, but the increase

in the three following years was quite remarkable.

In the total of forty-five ships which effected 108 passages through the canal in 1921, the Danish East Asiatic Company was represented by fourteen units making thirty-two passages, with a total of 158,000 tons net. Among the navigation companies regularly using the canal, the Danish East Asiatic is the only one whose vessels are exclusively motor-driven.

The following table shows the principal nationalities of the motorships passing through the canal during the period under consideration:

	English	Danish	Dutch	Italian	Swedish
1912.....	0	3	0	0	0
1913.....	0	4	2	0	0
1914.....	1	6	3	0	0
1915.....	1	11	9	0	0
1916.....	6	13	5	1	0
1917.....	7	5	3	1	0



Launch of another Sulzer two-cycle Diesel-engined ship, the "Hosdorf" at the Howaldtswerke, Kiel, Germany

1918.....	6	2	0	1	0
1919.....	7	11	1	1	2
1920.....	19	13	1	1	3
1921.....	15	14	4	2	5

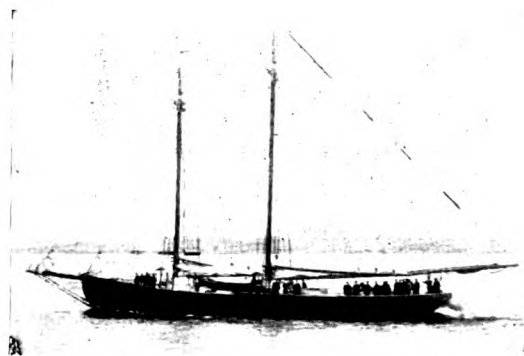
The above information is taken from the Bulletin *Decadaire*, published by the Suez Canal Company.

MORE SULZER AND DOXFORD DIESEL LICENSES IN GREAT BRITAIN

Licenses to construct Sulzer marine-type two-cycle Diesel-engines are held by Workman, Clark & Co. of Belfast, Ireland, and by the Fairfield Shipbuilding Co. of Glasgow, Scotland, who together with Doxford & Sons of Sunderland, England, are subsidiaries of the Northumberland Shipbuilding Co. It is interesting to know that both Workman-Clark and the Fairfield Shipbuilding Co. also own a license to build the Doxford opposed-piston Diesel-engine, and arrangements have been made for engines of this design to be built by both companies, marine engines of 3,000 i.h.p. now being under construction.

TRIALS OF THE "JULIUS SCHINDLER"

A speed of 10 knots on a fuel-consumption of 5½ tons per 24 hours was attained by the new single-screw motor tankship "Julius Schindler," which is propelled by a 6-cylinder A.E.G.-built Burmeister & Wain type Diesel-engine turning at 125 R.P.M. The "Julius Schindler" is owned by the Julius Schindler Oil Works at Hamburg, and left Germany on February 23rd for Philadelphia, Pa., where she arrived on March 18th. The only damage en route was on the rudder quadrant, the engine running without trouble. Her crew consists of 28 officers and men including four engineers, three junior-assistants and three oilers. In the engine-room there are two auxiliary oil-engines, namely a 40-K.W. surface-ignition engine driving an electric generating-set and a 45-K.W. Burmeister & Wain Diesel-driven generating-set. While the A.E.G. steering-gear is of the electric type, the windlass, winches and cargo-pumps are steam-driven.



The Fishing-Schooner "Mary E. O'Hara" on her trial-trip

BOLINDER-ENGINE FISHMAN "MARY E. O'HARA" RUNS TRIALS

OWING to the satisfactory operation of Bolinder oil-engines in their fishing schooner "Pioneer" and in many others in the fishing-fleet, O'Hara Brothers, of the Boston Fish Pier, ordered one of the new type Bolinder engines for their schooner "Mary E. O'Hara." The trial-trip of this fine craft, illustration of which we publish on this page, was held on April 20 at Boston, Mass. This schooner was built by Arthur D. Story at Essex, Mass., from whose yard so many fishing craft have come, and is of the following dimensions:

Length over all.....	103 ft. 0 in.
Length water line.....	92 ft. 0 in.
Breadth	22 ft. 8 in.
Depth	9 ft. 0 in.
Draft	12 ft. 3 in.
Tonnage, gross	108.2 Tons
Tonnage, net	49 Tons
Horse Power	100 B.H.P.

Regardless of trial trips of new oil-engined vessels becoming more and more frequent of late considerable interest is being taken by the fishermen in these trips. When the "Mary E. O'Hara" was brought from Gloucester after rigging to the Boston Fish Pier where her engine was waiting, there was a large gathering on the dock to watch the operation of installing the engine. The work was pushed as fast as possible and when the hour set for the trial came there were several parts remaining to be connected up. As the last connection was made the skipper, Capt. Dobson, cast off the lines and the engine-room was signalled.

Without any preliminaries or adjusting the engine was started and the "Mary E. O'Hara" proceeded on her trials. Even the flooring in the engine-room was not laid when the trials took place, so urgent is it these days that a commercial-craft get into productive operation just as soon as possible after the investment is made. Although this engine is of a somewhat new design the engineers obtained a quick start and perfectly satisfactory operation. A new form of head-construction eliminates water-injection with its attendant piping, making for simplicity. An ignition-device consisting of ignition-plug fitted into a valve in the ignition-bulb, 12-volt electric-generator driven by a chain off the crankshaft of the engine, battery and cables makes quick-starting possible and eliminates torches, also insures steady idling at the lowest revolutions. The engine has two cylinders operating on the two-cycle principle, each cylinder being 13 inches by 13 3/4 inches and develops 100 brake h.p. at 325 r.p.m. No air-compressor is required for injection or reversing, the engine being direct-reversible by ignition. Needless to say, this engine is very compact, as a fishing craft has little space to devote to an engine-room. A 49-inch by 40-inch Columbian bronze propeller drives her at a little over eight knots.

The installation of oil-engines in the new schooners being built to-day is bringing about a slight change in the form of these craft, as

usually the engine is installed as far aft as possible to fit it in; therefore the vessel's form is becoming fuller in the quarters in order to provide proper bearing and volume of displacement, but not full enough to detract at all from the wonderful seagoing qualities of these world-famous craft.

The "Mary E. O'Hara" performed so well on her trials that many fishermen are contemplating installing oil engines in their craft. Surely, after such performances as this, the road of a salesman for a gasoline-engine for fishermen would be a hard one indeed. This vessel is now in service and giving satisfactory results.

ANOTHER FISHERMAN WITH A BOLINDERS OIL-ENGINE

Elsewhere in this issue is a brief story of the trial trip of the Boston fishing-schooner "Mary E. O'Hara," owned by O'Hara Brothers of the Boston Fish Pier. Hardly had the trials of this craft been completed when they ordered a still larger direct-reversible Bolinders oil-engine, which will be installed in their new schooner "Lark." Richard Diebold, of Newcastle, Maine, is building this fisherman, which will be put under command of Capt. Ernest Parsons. This new addition to the O'Hara fleet will be of the following dimensions:

Length over all	126 ft. 0 in.
Length (measurement)	115 ft. 0 in.
Breadth	25 ft. 0 in.
Depth	11 ft. 0 in.
Draft	13 ft. 0 in.
Tons, gross	140 tons
Horse Power	175 B. H. P.

Considering that this firm first installed a 70 h.p. Bolinders engine in the "Pioneer," then a 100 h.p. Bolinders engine in the "Mary E. O'Hara" and now are installing a 175 h.p. Bolinders engine in the "Lark" it would seem conclusive evidence that they were satisfied that the oil-engine is the proper power for a fishing-vessel. A Columbian bronze propeller 66" diameter will give this new craft a speed of 10 knots.

ITALIAN SUB-CHASERS CONVERTED TO OIL-ENGINE FISHING CRAFT

Gasolene engines have been removed from a large number of Italian sub-chasers and converted into oil-engine power. These boats have been put into the trawling trade. Under the patronage of the Royal Navy a small company has been formed with General Martinez (a leading Italian naval-architect) as president, to exploit certain shoals at the mouths of rivers and in places inaccessible to sailing-craft to supply Rome with fish. Ansaldo San Giorgio surface-ignition oil-engines of 50 b.h.p. have been fitted and two boats have been given by the Navy. The cost of these engines is 100,000 lire apiece.

QUOHOG-DRAGGER "LOUISE PERRY" FITTED WITH OIL-ENGINE

The New England coast is plentifully supplied with clams, the largest variety of which is called the "quohog." These lie on the muddy bottom of the sea and are caught by dragging the bottom with a large rake which

gathers the quohogs in and brings them to the surface. Most of the quohog-draggers are small motor-boats having large clear deck and hold aft, with a mast and drag-handling gear amidships and a pilot-house forward with the engine-room and crew's quarters.

Among the fleet is the "Louise Perry," owned by Capt. Hezekiah Quinn of the quaint little island of Nantucket, off the Massachusetts coast. She was built in 1900 and is of the following particulars:

Length over all	43 ft. 7 in.
Breadth	14 ft. 0 in.
Draft	5 ft. 9 in.
Tonnage, gross	25 tons
Tonnage, net	21 tons

Formerly powered with a 50 h.p. gasoline-engine she made seven knots on 5 1/2 gallons of gasoline. Noting the economy of oil-engine boats Capt. Quinn had the gasoline-motor removed and Byron N. Sellers installed a 37 1/2 h.p. Dodge heavy-oil engine at the plant of the Atlantic Works, East Boston, Mass. The "Louise Perry" now makes eight knots on 1.9 gallons of cheap fuel-oil, effecting a saving in fuel-cost of \$1.34 per hour, not to mention the added speed.

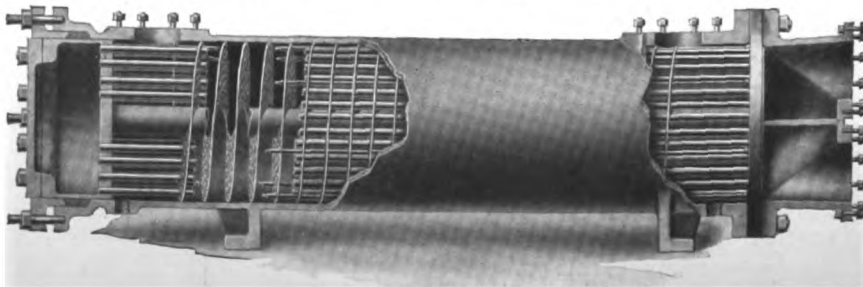
One-man control of the engine and boat is provided in the pilot-house, a wheel mounted on a vertical-shaft alongside the steering-wheel being connected to the reverse-gear, while the controls of the engine-speed are also within reach. By means of shafting driven off the main-engine a Hathaway clutch transmits power to the winch-head for hauling the drag.

OIL-COOLERS FOR DIESEL-ENGINES

Satisfactory operation of large Diesel-engines is dependent upon the bearings being furnished with oil under pressure at proper-temperature and viscosity to insure proper-lubrication. This is accomplished in Diesel-engines in the same manner as is standard-practice for turbine-lubrication cooling-systems; namely, the use of external oil-coolers through which the oil is circulated and kept at a proper-temperature, thus permitting the same oil to be used continuously, water being used as the cooling-medium.

It is also necessary to have a separate cooling-system to cool the water used in the cylinder jackets and for piston and exhaust-valve cooling. The water used for this purpose must be free from mud and must not throw-down scale at the operating-temperature, as otherwise these impurities would soon fill the water-space, with serious results. This water may be cooled by forced-circulation in a closed-circuit external to the engine in which the same quantity of water is used continuously. The operation of the engine is not in any way affected by local water-conditions as the available water-supply is passed through an external-cooler, to cool the water in the Diesel-engine circulating system.

The multiwhirl cooler and made by the Griscom-Russell Co. of New York and as shown in illustration is suitable for both these cooling problems, one cooler being required for oil and one for the water. The patented helical-baffle insures a high rate of heat-transfer and a maximum-path of oil or water-flow through shell with maximum pressure-drop.



The Griscom-Russell Multiwhirl Cooler

AMONG THE MOTOR WORKBOATS

Commercial Motor Boat Activity on the West Coast

MOTOR boats have always played an important part in marine transportation on the West coast of the United States; probably there is no section of any coast where small commercial motor-boat activity is so highly developed as there or where the internal-combustion engine is employed in greater numbers. Recently marked interest has been shown by all forms of marine interests in the substitution of Diesel and surface-ignition oil-engines for both steam and other types of engines. The big item of fuel-cost is a tremendous factor in the selection of a power-plant for any vessel and increased cost or reduced supplies of gasoline, kerosene and distillate have also aided in making owners of work-boats realize even more than ever the great advantages of engines using heavy-oils for fuel—and very little of that.

MOTORSHIP has previously mentioned a great many installations of small Diesel and surface-ignition oil-engines in these West coast boats. The accompanying list of additional installations is by no means selected; no attempt is made to publish this as a complete list. It is simply a grouping of the many news items which have come into our office during the past month. Yet it is sufficient to prove even to the most skeptical that there IS business for naval architects, boat and shipbuilders, engine manufacturers, marine hardware and equipment manufacturers, lumber dealers, paint manufacturers, rope makers, and all the various trades which are affected when even one boat is contracted for. Consider the orders for various firms, the employment thereby created, the spirit of optimism engendered and the actual, cold-cash profits which are involved when a group of contracts for vessels and machinery even of such a moderate size as that following is placed.

Boat builders and Diesel-engine builders on the West coast are very busy. Some of their plants are working overtime, which few, if any, plants in other sections of the country are doing. Other engine-manufacturers not situated on that coast are shipping oil-engines there for installation. The same economical conditions obtain on the other waters of this country; Diesel and oil-engines will save profits on the East coast, the Gulf, the Great Lakes, the inland rivers and canals just as truly as on the West coast. We do not say that there is no activity in these sections, but we do feel that this activity is not one-quarter what it should be. Our harbors continue to be filled with un-economical steam-driven tugs, lighters, freighters, fishing-trawlers and various small work-boats which on the West coast are to a very great extent driven by Diesel or oil-engines. If owners of steam or gasoline-driven craft can demonstrate where and how they can operate their craft at lower cost (considering fuel, lubricating-oil, crew, repairs, upkeep, depreciation, insurance-costs and general efficiency) than a Diesel or oil-engine driven craft we shall be glad to have the data and will publish the same. But we know it cannot be done on the West coast where conditions are very favorable and we fail to see how it can be done elsewhere. We have published many an article containing data compiled by owners of boats who have operated both types of craft, and actual experience has taught these men that they cannot operate gasoline or steam-driven craft against craft driven by oil-engines. Our pages are always open to any who can prove otherwise. Meanwhile—the following paragraphs have their particular interest and indicate the large amount of new work in progress in addition to that already reported in our pages.

The tug-boat "Panama," owned by the

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Oakland Launch & Towboat Co. of Oakland, Cal., is now in service after having had the 85 h.p. 3 cylinder Atlas distillate-engine removed and a 125 h.p. Atlas-Imperial Diesel-engine installed. A record of her operation will be available after a few months of service.

"Yolo," a freighter owned by the Bay and River Dredging Co. of San Francisco, Cal., is to be propelled by a Diesel-engine. She has just had a 55 h.p. Atlas-Imperial installed at their plant.

In our February issue, on page 117, we mentioned that the whaler "Herman" owned by H. Liebes & Co., of San Francisco was to be Diesel-powered. This installation has been completed and satisfactory trial-trips run. Early in April she sailed for Alaskan waters under command of Capt. Peterson. On her trials whale-oil was used for fuel with good results, we understand. The trip of the "Herman" in northern waters is for about seven months. Her engine is a 250 h.p. Atlas-Imperial Diesel-engine.

One of the recent installations of a Diesel-engine in a tug-boat was that of the 55 h.p. Atlas-Imperial engine in Capt. A. E. Anderson's tug "Olava." She has been in service for about three months with the result that Capt. Anderson has ordered another Diesel-engine from the same company, but of 80 h.p. for installation in his tug "Rustler," which is used for towing rock and gravel barges from Napa to San Francisco.

In our March issue on page 201 it was stated that A. L. McNeeley of the Pacific Tow Boat

Co. of Seattle, Wash., was having a 55 h.p. Atlas-Imperial Diesel-engine installed in his new tug. She has been completed and is now at work.

In their tow-boat, which is used for towing log-rafts, the Transit Towboat Co. of Raymond, Wash., have installed a Diesel-engine made by the Atlas-Imperial Engine Co.

In another tug owned by F. E. Drane of Bandon, Oregon, has recently been fitted a 55 h.p. Diesel-engine of the same make.

The San Juan Fish Co., of Seattle, Wash., operates a fleet of vessels, in one of which they are installing a 65 h.p. Atlas-Imperial Diesel-engine.

Having removed the distillate-engine from their trawler "Lincoln," the Independent Fish Co. of San Francisco has equipped this vessel with a 90 h.p. Atlas-Imperial Diesel-engine which operates on one-tenth of the cost of fuel that the former distillate-engine required.

The Tacoma Tug and Barge Co., Tacoma, Wash., have ordered a 165 h.p. Atlas-Imperial Diesel-engine for their tug "Favorite."

To be installed in their tug "Corinne," which is used in Alaska, the Bristol Bay Packing Co. has purchased a 45 h.p. Atlas-Imperial Diesel-engine. Another 80 h.p. engine of the same make will drive their tug "Island Duke," which they recently purchased. When the installation in this tug is completed at the dock of the engine manufacturers in Oakland she will be shipped to Alaska on the deck of the six-masted vessel "City of Sydney."

A 90 h.p. Atlas-Imperial Diesel-engine is

also going to Alaska for installation in a boat owned by Chas. G. Warner of Juneau.

The U. S. Government has purchased a 300 h.p. six-cylinder Atlas-Imperial Diesel-engine and a 55 h.p. auxiliary Diesel-engine.

A twin-screw Diesel-installation consisting of two 55 h.p. Atlas-Imperial engines is being made by The Mitchell Boat Works of Coeur D'Alene, Idaho, in a boat on the lake at that place.

Three 55 h.p. Atlas-Imperial Diesel-engines have been ordered for shipment to Milwaukee, Wisconsin.

A 125 h.p. Atlas Imperial Diesel-Engine will be installed in each of the two 65 ft. trawlers building by W. F. Stone & Son of Oakland for the Western California Fish Co. of San Francisco.

A Fairbanks Morse surface-ignition oil-engine of 100 h.p. is being installed in the cannery-tender "Mary Ellen," a new boat building at the works of the Western Boat Building Co., Tacoma, Wash. This vessel will ply between Cape Flattery and Everett, Wash.

A new 70 ft. tug for Cathels & Sorenson, loggers on the West coast of Vancouver Island, is being built at Victoria, B. C. which will be powered with a heavy oil-engine. She is from designs by Lee, Brinton & Wayland, of Seattle, Wash.

The former steamer "Osprey" owned by the Fisheries Commission, and used in Alaskan waters for several years, has been purchased by the Foss Launch Co., of Tacoma, Wash., who have had a 100 h.p. Fairbanks Morse oil-engine installed. This company operates a number of craft with this type of engine.

In the Siberian fur-trading fleet very hard service is met. Oil-engines have driven many of these craft, the latest installation being a 75 h.p. Fairbanks Morse surface-ignition oil-engine in the "Iskum" owned by the Phoenix Northern Trading Co. of Tacoma, Wash. The work is being done at the yard of the Western Boat Building Co., at Tacoma.

The State Harbor Commission of California inspection-boat now nearing completion at the yard of the Pacific Boat Co. of Oakland, Calif., which will have a 100 h.p. Enterprise Diesel-engine will be named "Governor Stevens."

WORK-BOATS OPERATE ON BOILER-OIL

MOTORSHIP has often pointed out that Diesel-engines must be capable of operating continuously on fuel-oils of low degree Baumé scale when necessary, not only because of the decreased cost of these heavy oils but also because some of the oil companies have indicated that the supply of Diesel-oil will eventually be less in quantity and higher in cost. Several articles have appeared in MOTORSHIP giving the experience of various engineers with the use of 14-degree to 18-degree Baumé oils, but these installations have been of greater power than the majority of engines installed in the work-boat fleet of this country. There are hundreds of tug-boats, lighters, canal-barges, cargo-boats of various sizes which are driven by oil-engines of moderate power, say 50 to 200 h.p.



The "Three Sisters" (on left) and the "Rover" (on right) being converted to Diesel-drive

but, for the most part, the fuel used in these engines is Diesel-oil of 24 to 30 degree Baumé.

We are, therefore, very much interested in learning of the results of the use of heavy-fuel oil in a small work-boat installation made by the Enterprise Engine Co. of Oakland, Cal. Our readers will remember that this engine is of the solid-injection type and was described in our February, 1921, issue on pages 134 and 135. This installation which has come to our attention is one of 100 h.p. which demonstrates that small Diesel-engines can be operated on



The "Three Sisters," which now has a 100 h.p. Enterprise Diesel-engine

heavy bunker-oil by the average engineer in small boats. One of our illustrations shows two craft hauled out on the marine railways at the yard of Anderson & Siemer, Oakland, where their former power-plants were removed some time ago and Enterprise Diesel-engines installed. On the left is the fish-carrier "Three Sisters" owned by A. Paladini, Inc., of San Francisco, while the former steam-tug "Rover" is on the right. This latter craft is in service, but sufficient time has not elapsed to enable us to publish operating data.

However, in the case of the "Three Sisters," which has been operated by the Diesel-engine for about ten months, accurate data has been obtained and comparison with the previous installation made. The owners state that the engine has given surprisingly satisfactory service although operated by men who were utterly unfamiliar with engines of the Diesel-type before this installation was made. They are enthusiastic about the ease with which it is operated under Diesel-power and over the fact that the speed of the boat is greater now than when powered with a 110 h.p. distillate-engine. She is now one of the fastest of the fleet, and because of this is being used as "pick-up" boat, making round-trips to the fishing grounds daily. This involves continuous operation twelve to fifteen hours each day under all conditions.

The owners state that "no repairs have been made to the engine so far. The saving in fuel and oil is enormous. The gas (distillate) engine that was previously in the 'Three Sisters' consumed approximately \$200.00 worth of fuel a week, whereas the Enterprise Diesel-engine has never consumed as much as ten barrels of 14-degree Baumé fuel-oil costing less than \$16.00 a week and operating more hours than any week when the gas (distillate) engine was in the boat." By doing a little quick calculating it will be seen that the saving in fuel alone in one year is sufficient to more than pay for the first cost of installing the Diesel-engine in the boat. The increased speed and usefulness of the boat are features obtained at no cost. There is a saving in cost of lubricating-oil, as well.

At one inspection which was made after seven weeks of operation the engine was opened up in the presence of several engineers

and it was found that the surfaces and cylinder-walls and valve-seats were in a clean and perfectly satisfactory condition. During these weeks the fuel used was 17-degree Baumé oil heated by the Enterprise system, starting on 27-degree fuel until the engine is warm, and also using this fuel just before stopping. The "Three Sisters" is 59 feet 10 inches in length over all and 14 feet breadth.

The "Rover," which is shown in our illustration, is 63 feet length over all, 15 feet breadth and is owned by Osborn and Bornholdt, being used on San Francisco Bay and the Sacramento River in general towing service. The owners, in converting her from steam to Diesel-power are taking a step which will result in increased profits.

KEY ROUTE DIESEL-ELECTRIC FERRIES

For the new Diesel-electric Key Route ferries for San Francisco Bay which are being built at Los Angeles, Allan Cunningham auxiliary electrical equipment throughout has been ordered.

REMARKABLE ECONOMY OF TWO WORK-BOATS

IN our December, 1921 issue of MOTORSHIP on page 989 was mentioned the savings in fuel-cost, the increased speed and greater efficiency which the installation of Diesel-engines in the freighter "Suisun City" effected as compared to the previous installation of distillate-engines. Since this craft has been in operation for several months and has shown such marked economy the owners, Hunt, Hatch & Co., commission merchants, of Oakland, Cal., have converted another of their freighters, the "Lark" to Diesel-power. Desiring to give our readers absolutely authentic figures on the almost un-believable saving in cost of operation of these two Diesel-installations we wrote to the owners, who gave us the following data.

After using Atlas distillate-engines for several years this company decided to install the new Atlas Imperial Diesel-engine, as the economy appeared to be so great. Two 65 h.p. distillate-engines were therefore replaced by two 55 h.p. Diesel-engines with the result that every economy claimed was realized in actual service. On a trip of 28 hours running-time the following figures for cost of operation were obtained:

Cost of fuel and lubricating-oil per trip with distillate-engines.....	\$46.00
Cost of fuel and lubricating-oil per trip with Diesel-engines.....	7.35

Saving per trip.....	38.65
----------------------	-------

In addition to this saving the "Suisun City" is capable of a speed of one knot more with the Diesel-engines than with the former power plant. Needless to say, the wonderful economy of this installation was conclusive proof that this company could not continue to operate their boats with the older type so a 150 h.p. Atlas Imperial Diesel-engine was installed in their freighter "Lark," a 125 h.p. distillate-engine being removed. A gain of two knots in speed resulted as well as very satisfactory savings in operation-costs on a trip of 28 hours actual running time.

Cost of fuel and lubricating-oil per trip with distillate-engine.....	\$61.10
Cost of fuel and lubricating-oil per trip with Diesel-engine.....	7.52

Saving per trip.....	\$53.58
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Interesting Notes and News from Everywhere

The new passenger motor-liner for the North German Lloyd will have accommodation for 300 to 400 passengers.

The auxiliary twin-screw schooner *Cap Finisterre* has been sold to American owners and she is now on her way to the United States.

The name of the single-screw motorship now building for the Swedish Lloyd to have Götaverken-B. & W. Diesel engines, is the "Trinacria."

On her maiden round voyage from Rotterdam to Batavia D.E.I., the new 9,800 tons displacement motorship "Kedoe" of the Rotterdam Lloyd Line burned 8 tons of fuel-oil daily.

Several Thornycroft high-speed coastal launches have been purchased in Great Britain by the U. S. Navy Dept. They are of the so-called "skimmer" class.

The Glen Line has received delivery of the 14,000 tons motorship *Glenbeg* from Harland and Wolff. She is the fourth motorship for this line to be built to the same design and will be placed in the Eastern trade.

Recently the Finnish steamer "Pallas" ran into the motor passenger cargo-ship "Domala." The collision caused some serious hull damage to the "Domala" and repairs will take until the end of June.

The Nakskov Shipyard of Nakskov, Denmark who built the motorships "Mexico," "Java," "Bintang" & "Arizona," and the Mommark motor-ferry showed a profit of Kr. 1,553,980.89 during 1921.

John C. Ogden of San Francisco, proposes to install Diesel engines in the steam schooners "Thomas L. Wand" and "Wethersley," which he recently purchased. The vessels will be used in the lumber trade.

Some characteristics of petroleum oils used on Diesel engines was the title of a useful paper recently read before the Diesel Engine Users Association at London, by Harold Moore.

"Cynthia," Merrill B. Mills' 129 ft. Winton Diesel-engined yacht, which was recently launched at Todds' Tebo Yacht Basin, Brooklyn, will shortly run trials. Her motors each develop 225 b.h.p.

The "Arizona" which is the fourth 10,000 tons motorship to be owned by the United Shipping Company of Copenhagen, is due to be launched this month. Their third motorship, the "Louisiana" left Europe for South America.

Trials of the Asiatic Petroleum Company's 1,095 tons d.w. new motor tanker "Fu Kwang" were carried out on April 21st. Three Bolinder motors of 320 h.p. each are installed. A contract speed of 10½ knots was exceeded by 0.40 knot.

Trials of the motorship "Rhea" owned by the Royal Netherlands Steamship Co., and of the motorship "Hallfried" owned by the Kleppe Shipping Co., were recently run in Holland. Both vessels are propelled by Werkspoor four-cycle Diesel engines.

The Transatlantic Steamship Co.'s (Gothenburg, Sweden) 9,400 tons motorships

"Yngaren," "Bullaren" and "Tisnaren" are to be placed in service between San Francisco & Australia and will supplant steamers, says Harry S. Scott of the General Steamship Corp.

The motorship "Segovia," a sister-ship to the "Sevilla," ran dock-trials in April at the works of Wood, Skinner and Co., Newcastle-on-Tyne. Her North Eastern Werkspoor Diesel-engines operated satisfactorily, although because of labor troubles the work of installation and trials was performed by apprentices.

The Diesel-powered houseboat "Miramar" was launched on May 1st from the yard of Kyle & Purdy, City Island, N. Y. This craft is being built from designs by Henry J. Gielow of New York for L. H. Eisenlohr of Philadelphia and will be propelled by two 120 h.p. Nelseco Diesel-engines.

At the yard of the Luders Marine Construction Co., Stamford, Conn. there is under construction for F. B. Stearns of Cleveland a motor-yacht to be powered with two Mianus oil-engines. She will be 86 ft. long, 15 ft. breadth and 4 ft. 6 in. draft, while the estimated speed is 13½ knots.

In a new 200-tons freighter built by the Hooghly Docking & Engineering Co., Calcutta, India, two 80 b.h.p. Bolinder oil-engines have been installed. Two Bolinder motors of the same power have also been installed in a 60 ft. tug built at the same yard. Both craft are for Cochin owners, and recently made the 1,500 miles trip to their destination.

Owing to great pressure of space we are obliged to postpone publication until July of a very interesting illustrated article by James Richardson on "Diesel-Machinery for Single-Screw Motorships." This paper was read at a meeting of the Institution of Naval Architects in April, at the Spring meeting and contains much valuable data on single-screw motorships.

The majority of motorships carry oil separators in their engine rooms for filtering the lubrication-oil. The new North Eastern-Werkspoor Diesel-engined passenger- and cargo vessel *Sevilla* has two DeLaval separators installed, and her sister motorship *Segovia* also will have a pair. The *Sevilla* was the British ship to go to sea with Diesel engines that were not tested in the factory.

It has been reported that the Cia. Sud Americana de Vapores (South American Steamship Co.) have purchased two large motorships from British shipowners, which probably will be used in the transportation of nitrate from Chile to Europe. At the present time this company does important coastwise business between Chile and Panama and is a Chilean Corporation.

When the motorship "William Penn" was recently in New York loading for the Far East, the representatives of a well-known oil company went aboard and offered to supply oil-fuel of 22 degs. Baumé at 3½ cents per gallon. As the "William Penn" only burns 13 tons per day, fuel at \$10.29 per ton makes a very economical proposition, and is equivalent to coal at \$2.25 per ton at any port in the world.

"Arizona" is the name of the new cargo motorship now under construction by the Nakskov Shipyard, Nakskov, Denmark, for the United Steamship Company of Copen-

hagen. This vessel will be propelled by two Burmeister & Wain Diesel-engines of 2600 total i.h.p. In addition to this craft the United Steamship Co. are also having built by the Nakskov yard a smaller motorship to be powered by two Høiby Diesel-engines of 550 i.h.p.

At the annual meeting of the stock-holders of the Wm. Cramp & Sons Ship & Engine Co., Philadelphia, Mr. J. H. Mull, President, stated that in the event of constructive legislation being enacted by Congress, it is believed that the principle shipyards of the U. S. A. will be occupied in the construction of high-grade passenger vessels and in the conversion of many existing steam-driven craft into motor-vessels.

According to Lloyds return for March 31, 1922 work had actually been commenced on 29 motorships aggregating 133,991 gross tons in Great Britain; compared with 60 vessels of 263,180 gross tons a year previous. Actually under construction in the World on March 31, 1922, were 114 motorships of 293,593 gross tons. It is surprising to learn that Italy is now constructing 20 wooden full-powered motorships aggregating 7,308 tons gross.

Four 14-knot combination passenger and cargo Diesel-driven motorships of 4,000 tons gross will be built in Scotland for the Western Australian Government. Refrigeration space for 2,500 tons of frozen meat will be provided, and there will be accommodation for about 200 passengers. These are the vessels referred to on page 374 of our May issue. The London office of the Australian Government has been a subscriber to "Motorship" for several years.

The next motorship to be launched at the Deutsche Werft will be the first of three 8,000 tons vessels for Wilhelm Wilhelmsen of Tonsberg, Norway. Two of these motorships were originally ordered by the Hamburg-Amerika Line, but as the government financial assistance was insufficient in view of the increased cost of construction in Germany they disposed of their contract to the Norwegian ship-owner who is completing these craft.

Quite a gathering of shipping men were present at the recent sale of the motorships "Astmahco III" and "Astmahco IV." The highest bid was \$140,000 by the bondholders in connection with which bid we understood the stock of the owning company was taken as collateral at par. A bid of \$100,000 was offered by the Atlantic Chartering Company, and there were at least six or seven other genuine bidders. The bill of sale was recorded as being made to Charlton B. Hibbard.

At the Deutsche Werft, Hamburg, the 7,500 tons D. W. motorship *Isis* was launched on April 25th. She is of 3500 gross tons and will be operated by the Kosmos Line in the South American trade, the dimensions being 114.3 m (375 ft.) length, 15.7 m (51 ft. 6 in.) breadth and 8.63 m (28 ft.) depth. Two Burmeister & Wain six-cylinder Diesel-engines of 630 mm. (24.8 in.) bore and 930 mm. (36.61 in.) stroke totalling 2300 brake horse-power will drive her 11 knots. Her displacement is 9,850 tons.

In our April issue on page 273 we made mention of a new 100 h.p. Fairbanks Morse oil-engined tow-boat which H. Tellefsen of Staten Island, New York harbor would shortly put into service. This craft is the "Florence T" and is now in service doing splendid work. When this oil-engined tug has been operating

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for some time and opportunity is afforded for accurate data to be obtained we hope to be able to give our readers a fine article covering the comparative costs of operating gasoline, steam and oil-engined tugs by the same owner.

Word has just reached us that the auxiliary schooner "Atlas," owned by Peter Wold and powered with a 55 h.p. Atlas Imperial Diesel-engine, has completed six-months of halibut-fishing out of Ketchikan, Alaska, covering during this period a distance of about 12,000 miles facing the worst weather known on the Pacific Ocean. Capt. Wold found that no trouble was experienced in all this time in these first months of operation nor did the varying temperatures on the fishing-banks affects the engine, although it was often running for three weeks without a stop.

W. E. Martin has been placed in charge of the marine work on the Pacific Coast of the Westinghouse Electric and Manufacturing Company, with headquarters in San Francisco. He joined the company in 1915 and has been an active proponent of Diesel-electric propulsion. He received his degree in electrical engineering from the University of Colorado and is an associate member of the A. I. E. E. and the Society of Terminal Engineers. Hunt, Mirk and Company will remain as special representatives of the Westinghouse company on the Pacific Coast.

We are advised by the Atlas-Imperial Engine Co. of Oakland, Calif., that they recently placed an order for castings and forgings for ninety engines varying from 90 to 300 horsepower. In their letter advising us of this activity were mentioned 41 individual installations of their engines being made. Surely the Diesel-engine of smaller size is coming into favor; such a large number of installations by a single manufacturer should convince the operators of small steam-propelled craft that there must be something very real back of MOTORSHIP's contention that small Diesel-engines are replacing small steam-plants.

In our issue of December, 1918, we described and illustrated five Diesel-driven trawlers of 500 b.h.p. built by Augustin Normand of Havre, France. Syren & Shipping says that three of these craft have been converted into motor freighters, and re-named *Cite de Sparte*, *Cite d'Athens*, and *Cite de Patras* by the Oliver Navigation Co., who operates them in the Mediterranean. However, the last named vessel capsized in a heavy sea, but her Diesel engine was running until after she turned over. The other two boats had been 150 and 170 days at sea since Nov. 6th, 1920 and Jan. 1st, 1921, respectively up to the date of the report. They carry 400 tons at 9.5 knots on a daily fuel consumption of 2.4 tons.

A 400 FT. SINGLE-SCREW MOTORSHIP OF 3,000 H.P.

One of the most interesting merchant-vessels ordered for a year has just been placed by Alfred Holt & Co., Liverpool. This consists of a single-screw vessel with a 3,000 i.h.p. long-stroke Diesel engine turning at 80 to 85 R.P.M.—the engine order having gone to Burmeister & Wain of Denmark and will be of the four-cycle type with eight single-acting cylinders. This is the same shipowning company that recently placed an order with Scotts for a "motor-steamer" to be fitted with a Scott-Still combination oil and steam engine.

It also will be remembered that two 8-cylinder 3,000 h.p. long-stroke Diesel-engines have just been completed by Burmeister & Wain for a large twin-screw motorship now completing for the Ocean Steamship Company of Liverpool, which is a subdivision of Alfred Holt & Company.

MOTOR WORK-BOAT CONSTRUCTION IN RUSSIA

A large passenger motorboat is now building at the Archangel Fishing-Circuit Boatyard for service between Novoye Zemlaa and other islands.

THREE MOTORSHIPS FOR CHILE

An order for three Diesel-driven motorships has been placed with the Danziger Werft of Danzig by Chilean shipowners. We will shortly publish further details.

PACIFIC DIESEL CO.'S NEW YORK OFFICE

Announcement of the removal of their New York offices is made by O. S. Johanssen, Eastern Agent of the Pacific Diesel Engine Co. The new address is at 50 Church Street.

TWO TANKERS TO BE BUILT

Two small Diesel-driven motorships will very probably be shortly built for the New England Oil Refining Company of Boston, for service between Fall River, Mass., and Venezuela. They will be of about several thousand tons d.w. each.

SAID AT LAUNCH OF STEAMER

At the recent launch of the steamer "Alnmoor" of the Moor Line, Robert Haswell of Doxford & Sons (the builders), stated he trusted that at no distant date Sir Walter Runciman would decide to run his vessels with Doxford Diesel-engines.

MOTORSHIP "DOMINION MILLER" CALLS AT SAVANNAH

During the early part of April the new Doxford Opposed-piston Diesel-engined single screw motorship "Dominion Miller," owned by Furness Withy & Co., docked at Savannah, Ga., and loaded cotton and general cargo for Hamburg.

WOODEN MOTORSHIP "YPRES" SOLD

The American-built twin-screw motorship "Ypres" of 1,617 tons gross has been sold by the French Government to an Italian shipowning concern. This vessel was built by the Puget Sound Bridge & Dredging Co. of Seattle, Wash., in 1918, and fitted with two Skandia surface-ignition oil-engines.

TRIALS OF MOTORSHIP "LOUISIANA"

Recently trials took place of the twin-screw motorship "Louisiana," built by the Ardrossan Shipbuilding & Dry Dock Co. for the United Steamship Company of Copenhagen (Det Forende Dampskibs-Selskab). This vessel has been fitted with Burmeister & Wain type Diesel-engines built at Copenhagen and installed by the Ardrossan Company, in conjunction with John G. Kincaid of Greenock, who are one of the licensees for the Burmeister & Wain Diesel engine. During the trials the machinery worked with smoothness and without vibration. On four runs over the measured mile a speed of 11.2 knots was maintained.

TENDERS REQUESTED FOR SIX MOTORSHIPS

Invitations have been sent out by the Anglo-Saxon Petroleum Co., Gt. St. Helens, London, E. C., England (C. Zuever, Marine-Superintendent) for one, three and six 2,800 tons d.w.c. single-screw bulk-oil carrying motorships, speed 10¾ knots, length 270', breadth 46'6", depth 23', loaded draft 17'. The engine of each ship is to be a six-cylinder four-cycle Diesel model. We suggest that American Diesel engine builders should endeavor to bid on the main engines, as with prices ranging from \$60.00 to \$75.00 per shaft h.p. they may be able to compete, especially as the money exchange-rate is not far from normal. The

Anglo-Saxon Co. is a subsidiary of the Asiatic Petroleum Co. Sir Henry Deterding head of the company was recently in the U. S. A.

MOTORSHIPS FOR FRUIT CARRYING

The ideal type of vessel for world-wide use for carrying fruit perishables is of about 8,000 to 10,000 tons combination passenger and entirely insulated motorship, said E. L. Goodsell of the Fruit Auction Co. of New York, in a talk before the Foreign Trade Club at the Hotel Astor on May 17th. The speed, he continued, should be not less than 16 knots, and better, 18 knots. Accommodations for 120 passengers on the main deck would assist in minimizing the cost of operations. There should be 3 decks, and 4 chambers in the trunk of the hatch on each deck. This is necessary because each variety of food should be stowed in a separate chamber.

"DINTELDYK," 19,300 TONS MOTORSHIP

(Continued from page 443 of this issue)

Builders of Ship and Engines Harland & Wolff
Date Placed in Service Feb. 27, 1922

Her deck machinery is sufficient to load or unload any cargo as fast as the stevedores are able to handle it, an important feature in the movement of fruit, as it is necessary to get the product into cool space as soon as possible to keep it in the best of condition. In the case of oranges, the principal fresh fruit so far shipped by water, rail delays between the packing houses and the docks have been avoided by shipping the entire land distance, sometimes more than 100 miles, by motor trucks which run direct from the packing-house door to the ship's side.

The deck equipment consists of 34 winches, 36 ordinary derricks and two extra large ones, the first for 40 tons and the second for 20 ton loads. The winches are of the McFarland and Wilson type. Winches, windlasses and steering gear all are electric.

Driving at an economical speed of 12.75 knots the fuel-oil consumption averaged 18 tons a day, although at full speed the consumption will be 21 or 22 tons, according to A. A. J. Haman, the chief engineer. Captain R. Braun, the skipper, Mr. Haman and his chief assistant, K. A. Wybregt, who will become chief engineer on the second trip out from Rotterdam, found the "Dinteldyk" a thoroughly satisfactory vessel. Not a stop or slow-down had to be made on account of engine trouble and no attention was necessary to the machinery on arrival at San Francisco except the routine overhauling.

Reversing the engines, from full-speed ahead to full speed astern, was found to require only six seconds. Maneuvering, compared by her officers to a motor car for ease, was declared to be much quicker than steam. Considerable heavy weather was encountered, but nevertheless the propellers did not come out of the water and make necessary a test of the Aspinall governor.

In port the daily fuel-oil consumption was 1 ton a day. En route the lubricating-oil consumption averaged 15 gallons daily. The fuel oil used for the various legs of the voyage was as follows: London to Colon, 4,808 miles, 318.29 tons; Colon to Punta Arenas, Costa Rica, 470 miles, 27.24 tons; Punta Arenas to San Pedro, California, 2,521 miles, 167.1 tons. San Pedro to San Francisco, 365 miles, 22 tons.

Excellent accommodations for twelve passengers comparable with those of the best passenger liners are a feature of this motorship. They were filled on the outbound voyage, and were booked completely for the return trip before the "Dinteldyk" left San Francisco for Puget Sound.

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed)

OIL-ENGINE NOMENCLATURE

To the Editor of MOTORSHIP:

Sir: Answering your suggestion of two or three months ago in order to solve the question as to the most proper name for the so called Solid-Injection Diesel-engine, I would state that of all known names the words *Direct-Injection* appeal to me the most, as it is the most logical expression, and in addition to that it is easily pronounced. The name Solid-Injection certainly was introduced by some salesman and not by an engineer or the man with technical training, so must be abandoned. It sounds awkward and is wrong in its nature. Mechanical-Injection is a better name and the main reason against it is that this word is somewhat extensive and not so easily pronounced. The other words, as for example Airless-Injection have hardly any chance to gain popularity, and in fact this last name does not mean much, as there are a few methods of injection without the air, known in the past. One of them is injection by means of capsules, tried in Germany without any success a considerable time ago. The author himself is working now on the method of injection, which would not be a mechanical-injection or air-injection or anything tried up to this time. And nobody can tell if there will be any other methods of injection in the future, which must go under the classification of airless-injection.

So in my opinion the name Direct-Injection is the only suitable word in this case, as it has a broad meaning and can cover different methods of construction. In fact it is hardly possible to attempt to make the classification of various types of engines, which will draw a distinctive line between them, as there are many engines, in which different characters could be found, and so they may go under different classifications at one time. And so only approximate borders could be established.

It is possible to divide all kind of oil-engines in which the fuel-oil is injected into the cylinder at or near the upper dead-centre into two main groups: (I) Direct Injection, and (II) Indirect Injection.

Direct-Injection engines could be again subdivided into several types. First type, to which the name is the most applicable are the engines, in which the action of the fuel-pump is followed immediately by the injection and combustion. In other words the pressure of a pump-plunger upon the fuel-oil produces the injection and atomization. To the second subdivision could be referred the engines, in which the fuel-pump is used only to create the pressure in a vessel in the way of fuel oil between the pump and working cylinder, this vessel then discharges into the cylinder through a mechanically-operated valve, which usually constitutes a part of a sprayer or atomizer and is commonly called fuel-valve. As an example of the engines of first subdivision could be pointed out the Price-Rathbun engine or the engine of De La Vergne Machine Co. The most of the engines of direct-injection group however constitute the second subdivision, of which Vickers engine could be taken as an example. And

so finally the most distinctive feature of direct-injection engine is that the pressure of the fuel in a fuel feed system is used for the purpose of injection and atomization.

Indirect-injection, as the word itself indicates employs the method, which makes the use of some other means to drive the fuel charge into the cylinder. Therefore, here the fuel-pump discharges into a compressed air line and the compressed air discharges into the combustion-chamber, and consequently the injection is performed indirectly. In addition it could be mentioned that the same engine can operate on both principles, if its fuel-injection valve is so constructed that either of these methods of injection could be used. Or if the engine has two separate fuel valves, one for direct and another for indirect-injection.

All this was referred to the engines, in which the compression supplies the temperature, necessary for the ignition of a fuel charge. Another class of oil-engine, which does not carry this distinction is "surface-ignition" engine. This engine has many characteristic features which place it between Diesel and explosion type of engine. They are low-compression, injection of fuel during the suction-stroke or at the beginning of compression stroke, the presence of an incandescent body in the combustion chamber and combustion of charge at constant volume.

The best scheme to use perhaps for remembering, as well as for comparison is to construct a triangle, at the top of which should be placed a high compression air-injection Diesel-engine, the other two points occupied by medium compression direct-injection engine and a low-compression surface-ignition engine. At the centre of this triangle could be placed the Steinbacker or gas-injection engine, as it bears a resemblance with all above mentioned three types, and forming a separate group, to which also could be referred a well known in Europe Brons oil-engine. This engine receives its fuel charge during the suction-stroke from a low-pressure fuel-pump as with the surface-ignition type; but for the atomization of fuel uses a Steinbacker principle, while in the other respect it is a direct-injection engine.

N. ELMER.

TWIN-SCREW PROPULSION

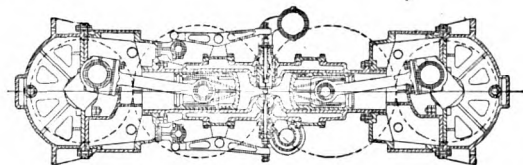
TO THE EDITOR OF MOTORSHIP:

A suggestion for twin-screw propulsion by an opposed-piston type of engine is herewith attached. The tracing was made from a Nelseco bulletin, by tracing up to the valves and then turning it end for end and tracing the other cylinder, to show the application, although it is apparent that it is equally applicable to any internal-combustion or single-acting steam-engine.

A great saving could be made in space and weight, as two cylinder-heads and one set of valves with their actuating mechanism are done away with. The center of gravity is lowered and vibration eliminated entirely, or reduced to a minimum (a thing

to be considered in canal boat propulsion) as the engine may be perfectly balanced, the reactions of the piston loads being taken by the moving parts instead of by the engine structure.

If one propeller should get snagged, both cylinders would drive the other screw, as the shafts would of course be connected by worm or spiral bevel-gear. The tracing is a literal copy, no attempt being made to design the engine to suit the new adaptation, which would be a simple matter for the engineering department, the idea being once grasped.



It seems to me that an installation of this kind would show greater economy than a Diesel-Electric drive, as, with two Kitchen Rudders—one for each screw, as great flexibility could be had as with electrical-drive without the weight and expense of generator, storage batteries, etc. No reversing gear would be needed and I do not believe the losses would be as great with the engine running all the time, (control being by the rudders) as would occur with electrical-drive, and the whole power plant would be simpler, and at least fifty per cent. (50%) lighter. A small direct connected generator set of, say 10 K.W. could be separately installed to run auxiliaries and light the boat.

Yours very truly,

D. C. CONKLING.

Balboa, Canal Zone.

TAKES "MOTORSHIP" UP A MOUNTAIN

TO THE EDITOR OF MOTORSHIP:

From actual experience with the March issue of your magazine "MOTORSHIP" I can recommend the same as making most interesting reading. I read my copy on the top of a mountain after a climb, with every ounce of weight counting on skis. I am on a vacation and had my copy of "MOTORSHIP" forwarded with my mail.

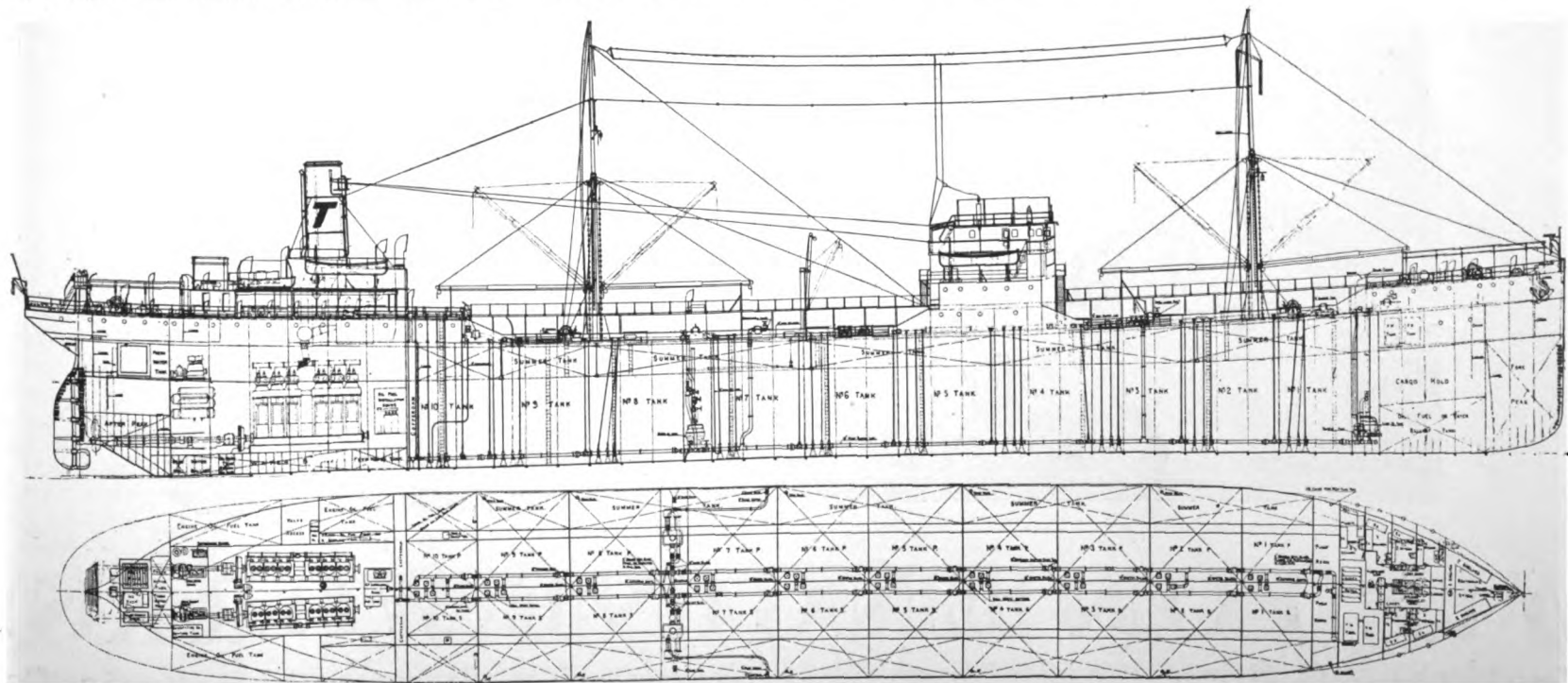
ERIK HILDESHEIM.

Copenhagen, Denmark.

[We have been obliged to hold-over many interesting letters until our July number.—EDITOR.]

OUR REGISTRY OF MOTORSHIP ENGINEERS

William Waterval, 201 East 28th St., New York. Engineer with 12 years' experience on internal-combustion and Diesel-engines, also first-class machinist. Chief-engineer on "Santa Isabel," "Santa Flavia," and "Santa Christina"; 1st Asst. Engineer on "Pennant" and "Sherewog"; 2nd Asst. Engineer on "Santa Elena," all six vessels being motorships.



General arrangement plans of the Vickers-built and Diesel-engined motor-tanker "Scottish Musician," described and illustrated on page 282 of our April issue. She is of 14,200 tons loaded displacement